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OF
NEW SOUTH WALES.

(SECOND SERIES.)

VOL. III.
WITH FORTY PLATES.

FOR THE YEAR 1888.

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ERRATA.—VOL. III.

(SECOND SERIES.)

- Page 18, line 7—for 1864 read 1868.
Page 22, line 21—for Tatchinidæ read Tachinidæ.
Page 34, line 14, last word but one—for anterior read interior.
Page 34, line 16—for anterior read interior.
Page 62, line 9—for anal appendages of the ♀ read anal appendage of the ♂.
Page 165, line 3—for Platos iv. and v. read Plates v. and vi.
Page 172, line 16—for Periopthalmus read Perioptthalmus.
Page 193, line 8—for Oryzia read Oryza.
Page 221, line 35—for Pneu, read Pneu-
Page 221, line 36—for Thyone- read Thyone,
Page 240, line 24—for PODOPTHALMUS read PODOPTHALMUS.
Page 267, line 23—for pinifolia read pinifolium.
Page 267, line 24—for humifusa read humifusum.
Page 360, line 24—for ACHRYANTHUS read ACHYRANTHUS.
Page 528, line 12—for finding read grinding.
Page 840, line 25—for E. dorsale read C. dorsale.
Page 897, lines 7 and 22—for Tessalodon read Tesserodon.
Page 1146, line 16—for Cecidomyiadae read Bibionidae.
Page 1169, line 21—for p. 47 read p. 64.
Page 1183, last line—for nigricolor read nigra.
Page 1292, last line—for N. reperta read N. reclusa.
Page 1342, after the description of H. HORRIDUS insert: - Port Augusta
(and probably other parts of S. Australia).

PROCEEDINGS
OF THE
LINNEAN SOCIETY
OF
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WEDNESDAY, 25TH JANUARY, 1888.

The President, Professor W. J. Stephens, M.A., F.G.S., in the Chair.

The President announced that no excursion would be held during the ensuing month owing to the heat.

DONATIONS.

The following Journals, Magazines, &c., for 1887 as published :
"The Athenæum ;" "Annals and Magazine of Natural History ;"
"Archiv für Naturgeschichte ;" "English Mechanic ;" "Entomologist ;"
"Entomologists' Monthly Magazine ;" "The Field ;" "Geological Magazine ;"
"The Ibis ;" "Journal of Anatomy and Physiology ;" "Journal of Botany ;"
"Nature ;" "Proceedings of the Royal Geographical Society ;" "Quarterly Journal of Microscopical Science ;"
"Science Gossip ;" "The Zoologist." Also "The Scottish Geographical Magazine." Vol. III., No. 12 (December, 1887). *From the Hon. W. Maclean, F.L.S., &c.*

"Bollettino dei Musei di Zoologia ed Anatomia comparata della R. Università di Torino." Vol. II., Nos. 27-32 (1887). *From the Museum.*

"Proceedings of the Zoological Society of London for the year 1887," Part III.; "Abstracts of Proceedings," 15th November, and 6th December, 1887. *From the Society.*

"Zoologischer Anzeiger." X. Jahrg., Nos. 265-267 (1887). *From the Editor.*

"Fünfter Jahresbericht des Vereins für Naturwissenschaft zu Braunschweig für das Vereinsjahr 1886 bis 1887." *From the Society.*

"A List of Birds of the Island of Ruk in the Central Carolines;" "On two Species of Pigeons from the Caroline Islands." By Otto Finsch, Ph.D., C.M.Z.S., &c.; "Diego Garcia und seine Soeschwaben." Von Dr. O. Finsch und Dr. R. Blasius. *From Dr. O. Finsch.*

"Revue Coloniale Internationale." Tome V., No. 5 (November, 1887). *De la part de l'Association Coloniale Néerlandaise à Amsterdam.*

"Archives Néerlandaises des Sciences exactes et naturelles." Tome XXII., Livs. 2me et 3me (1887); "Etude sur les Algues Parasites des Paresseux," par Madame A. Weber-van Bosse. *De la part de la Société Hollandaise des Sciences à Harlem.*

"The History of Creation." By Ernst Haeckel. The Translation revised by Professor E. Ray Lankester, M.A., F.R.S. *From F. A. Skuse, Esq.*

"Proceedings of the Cambridge Philosophical Society." Vol. VI., Part 2 (1887). *From the Society.*

Monatliche Mittheilungen des Naturwissenschaftl. Vereins des Reg.-Bez. Frankfurt." Jahrg. V., Nos. 1-6. *From the Society.*

"Feuille des Jeunes Naturalistes." No. 206 (December, 1887). *From the Editor.*

"Iconography of Australian Species of *Acacia* and Cognate Genera." Decades V.-VIII. By Baron Ferd. von Mueller, K.C.M.G., M. & Ph.D., F.R.S., Government Botanist of the Colony of Victoria. *From the Government of Victoria, through the Librarian, Public Library, Melbourne.*

"The American Naturalist." Vol. XXI., No. 11 (November, 1887). *From the Editors.*

"Annual Report of the Curator of the Museum of Comparative Zoology at Harvard College, for 1886-87." *From the Curator.*

"Proceedings of the Canadian Institute, Toronto." 3rd Series, Vol. V., Fasc. 1 (1887). *From the Institute.*

"Bulletin de la Société Belge de Microscopie." 14me. Année, No. 1 (1887). *From the Society.*

"The Olive and Olive Oil." By J. H. Maiden, F.R.G.S. *From the Author.*

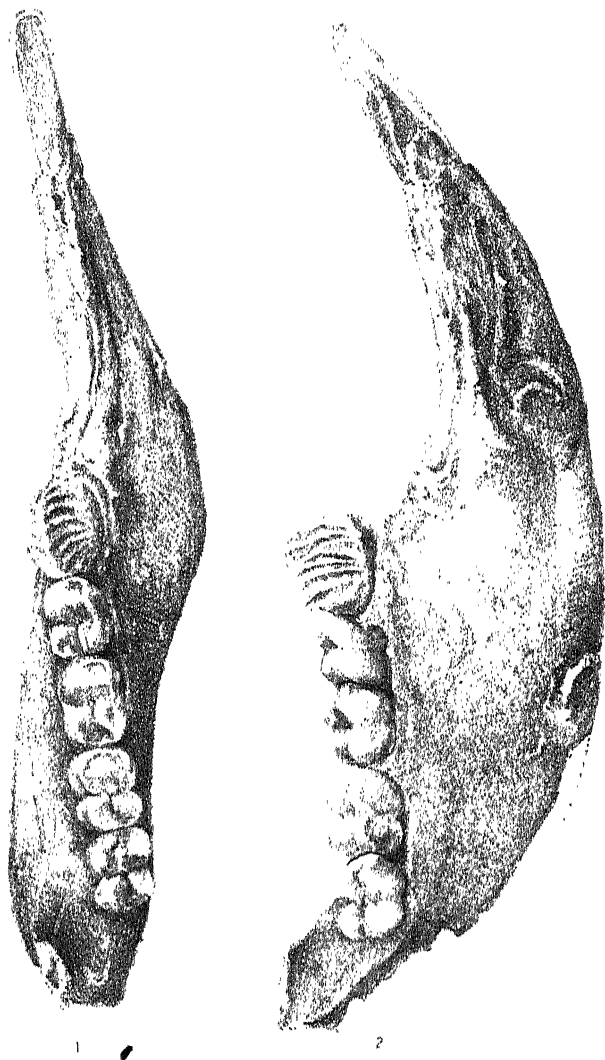
"The Journal of Conchology." Vol. V., No. 8 (1887). *From the Conchological Society of Great Britain & Ireland.*

"Nova Acta Regiæ Societatis Scientiarum Upsaliensis." 3rd Series, Vol. XIII., Fasc. 2 (1887). *From the Society.*

“The Quarterly Journal of the Geological Society of London. Vol. XLIII., Part 4 (No. 172), 1887; “List of the Geological Society, 1887. *From the Society.*

“Comptes Rendus des Séances de l’Académie des Sciences, Paris.” Tome CV., Nos. 14-19 (1887). *From the Academy.*

“The Transactions of the Entomological Society of London for the year 1887.” Part III. *From the Society.*



TRICLIS OSCILLANS.

1 Left ramus, (front view, nat size)
 2 " " (inner side view, " ")

G. S. Griffiths, lith.

ON AN EXTINCT GENUS OF THE MARSUPIALS
ALLIED TO *HYPSIPRYMNODON*.

By C. W. DE Vries, M.A.

Plate 1.

A somewhat obscure passage in the older writing on the palimpsest of the Marsupials has lately been brought to light by Mr. R. Frost, a gentleman who, by such success in this his first search among the archives of King's Creek, will doubtless be led to further discovery. A jaw of no mean size, it appeared, when seen by the writer on the spot, to have been derived from a gigantic *Hypsiprymnodon*, and this first impression, though considerably modified, has not been removed by subsequent study.

Its functional dentition is that of the Phalangistidæ and Pleopodidæ, $i-c-pm^2-m^1-m^2-m^3-m^4$, but the formula is not a full expression of its affinities. For convenience, and for the sake of brevity, these may be named as they appear in the course of description.

Jaw.—The fossil is a left horizontal ramus, perfect above to the base of the coronoid process inclusive, below to the parallel of m^2 . The molars being in horizontal position, the symphysis makes with them a very low angle (*Hypsiprymnodon*); its articulating surface commences anteriorly close to the incisive outlet, and, though long as well as deep, does not extend backwards beyond the vertical of the premolar (*Hypsiprymnodon*); immediately behind it is a distinct postsymphysial depression, and behind this again the jaw swells out and forms a prominent internal angle (*Hypsiprymnodon*, *Hypsiprymnus* occasionally). The incisive region is greatly produced, its length covering three and a-half of the molars (*Hypsiprymnodon*). The anterior half of the diastemal edge is occupied by the convex subtubular socket of the procumbent canine, the convexity and breadth of the socket decreasing till it merges into

a ridge which forms the posterior half of the diastema (*Hypsiprymnodon*, *Phalangista*); this ridge is defined on the outer side by a compression of the incisive socket beneath (*Hypsiprymnodon*, *Phalangista*), on the inner by a superficial groove between it and the articulating surface of the symphysis. Midway between the end of the canine socket and the premolar a depression marks the site of an anterior premolar (*Phalangista*, *Hypsiprymnodon*). The anterior orifice of the dental canal is large (*Phalangista*) and much in advance of the premolar (*Hypsiprymnodon*). The convexity of the lower edge of the jaw is greatest beneath the molars (*Hypsiprymnus*). The hinder part of the ramus is broken away, but a small portion of the anterobasal edge of the ectocrotaphyte fossa is preserved sufficient to shew by its inner surface directed forwards and downwards that it was widely perforated in continuity with the dental canal (*Hypsiprymnodon*, *Hypsiprymnus*).

Teeth.—The incisor is strong and relatively short (*Hypsiprymnus*), quadrilateral, cuneiform, its sides deep at the base and tapering rapidly forwards. Its upper surface is a continuous plane of wear, slightly concave longitudinally, and narrowing as it nears the base; its lower surface, moderately convex both transversely and longitudinally, is well clothed with enamel, which extends over the lower third of the lateral surfaces, and consequently surrounds and arms with a cutting edge the apical third of the tooth only; its lateral surfaces are flat, parallel, equal, and similar. On the upper end of the enamel of the inner lateral surface a distinct but small area, flattened and polished by wear, extends as a triangular facet a short distance downwards, indicating a laxity of the symphyseal ligament not sufficient to allow of attrition between the incisors to so great an extent as in the Kangaroo Rats. The canine is absent; its large open socket shews it to have been a functional tooth, though liable to be shed (*Hypsiprymnodon*, *Phalangista*). The premolar, in form a short oval, as broad as high at its posterior end (*Phalangista*, *Hypsiprymnodon*) is rather longer than it is high (*Hypsiprymnus* approximately) it is placed obliquely in the jaw, its degree of obliquity

being about the same as in *Phalangista*, that is, considerably less than it is in *Hypsiprymnodon*; it has the same number of ridges (six) as in the latter genus, but these are low, far apart, irregular in length and direction, and almost confined to the upper half of the tooth; intermediate, in short, between those of *Hypsiprymnodon*, and the ridges not infrequently developed in the premolar of *P. vulpina*. The crest of the tooth is highest anteriorly (*Phalangista*), where the penultimate ridge on either side meets its fellow in a prominent apical point; its base externally does not descend below those of the molars (*Phalangista*). The molars form a straight series of nearly equal breadth (*Hypsiprymnodon*). A close examination of the three posterior molars in *Hypsiprymnus*, *Hypsiprymnodon*, and *Phalangista*, leaves a strong impression that the Musk Rat is, in this part of its dentition, more nearly allied to the Phalangiers (as it is by its first molar and by its hind thumb) than to the Kangaroo Rats. It is difficult to translate this impression into words, but it might be said by way of essay that, in the Phalangiers the ridge or cusp of the fore lobe on the inner side is central and directly transverse, and the whole lobe very similar to the hinder one, and consequently the four parts into which the tooth is divided by the longitudinal sulcus and mesial valley are more regular in size and shape than in the Hypsiprymnidæ, which in the more undulated pattern of the molar surface approach the Macropodidæ. In this respect the fossil agrees with *Hypsiprymnodon*, but its molars have prebasal talons wanting in the Musk Rat, and these are phalangistine rather than hypsiprymnine in character. Each is crossed by a strong oblique link descending forwards from the outer end of the outer cusp, and becoming confluent with the inner moiety of the raised margin of the talon; the outer part of this rim, curving backwards upon the lobe, circumscribes a pit-like depression on that angle of the tooth in the three anterior molars, but, as in *Phalangista*, not in the last molar. The hinder lobe of this molar is not much smaller than its fore lobe. The breadth of the molar series taken at the fore lobe of m^3 is four times and one third in its length (*Hypsiprymnus*). The fore lobe of the first molar (m^1) is scarcely differentiated from

the other anterior lobes as it is markedly in *Hypsiprymnodon* and *Phalangista*, and bears indeed a near resemblance to that of *Hypsiprymnus*.

From this detail it would seem that the relations of the extinct animal were complex; capriciously, as it were, its relic yields us glimpses of each of the three families so frequently named, and on this ground it may perhaps deserve to retain its cabinet name, *Triclis oscillans*. Though its affinity to *Hypsiprymnodon* may be said to be paramount it must be confessed that it is not so to any great extent. Perhaps to some future historian of marsupial genesis the very ambiguity of its record may render it of greater value than that which would have been left by a veritable *Hypsiprymnodon*. What if under the guidance of its aberrant characters he is led to conceive that the Pleopodidæ, embracing thus an ultimate stage of differentiation in *Hypsiprymnodon* and a more generalised type in *Triclis*, are a continuation of a stock whence has arisen the Phalangistidæ on the one hand, the Hypsiprymnidæ on the other.

Dimensions.

Length to coronoid process.....	122 mm.
Height at m ³	32·5
Length of diastema.....	39
Length of molar series.....	44
Length of premolar	13·5
Length of incisor	22
Breadth of premolar.....	9·5
Breadth of m ²	10
Breadth of incisor	7
Depth of incisor at base.....	10

ON THE GENUS *TETRAGONURUS* OF RISSO.

BY E. PIERSON RAMSAY, LL.D., F.R.S.E., AND J. DOUGLAS
OGILBY, F.L.S.

(*Notes from the Australian Museum*).

In the Proceedings of the Linnean Society of New South Wales, Vol. X., p. 718, the Hon. William Macleay has described and figured, under the name of *Otenodax wilkinsoni*, a fish which had been picked up dead on the beach at Lord Howe Island, and handed to him for identification by Mr. C. S. Wilkinson. In a subsequent volume of this publication—I. (2), p. 511—the same author contributes a note, in the course of which he mentions that it had been pointed out to him by Dr. Ramsay that this fish belonged to the genus *Tetragonurus* of Risso, and should therefore by rights be called *Tetragonurus wilkinsoni*.

The species is first noticed by Rondeletius, who in his *Libri de Piscibus* xv., p. 423 (1554), gives an account of a fish which had been sent to him from Pisa, and which he calls *Mugil niger*; he also gives a fairly recognisable figure of it. Rondeletius was followed by Gesner, Willoughby, and Aldrovandus, the latter of whom figured it under the name of *Corvus niloticus* in 1638.

From this date until 1810 no further example appears to have been noticed by ichthyologists, but in that year Risso (*Ichth. Nice*, p. 347, pl. x. f. 37) describes and gives a wretched figure of a recent specimen, applying to it the name of *Tetragonurus cuvieri*. Risso, along with all the authors preceding him, placed this species among the *Mugilidae*, but he subsequently (*Eur. Merid.* 1827, iii. p. 382) raised it to family rank, keeping it however next in order to the *Mugilidae*.

Cuvier and Valenciennes (Hist. Nat. xi. p. 172, pl. 318) however, writing nine years subsequently, restore it to its place among the *Mugilidae*, and give a fully detailed description, accompanied by a somewhat moderate figure.

In the Proceedings of the Zoological Society for 1839, p. 79, we next find the Rev. R. T. Lowe dissenting from this opinion, for, having obtained a Madeiran example in a fresh state, he comes to the conclusion, after a most exhaustive examination, that the genus was more closely allied to *Thyrstites*—at that time placed among the *Scombridae*, but more recently along with certain allied forms constituted by Dr. Günther as a distinct family, the *Trichiuridae*—than to the *Mugilidae*, and he therefore places it among the Trichiuroid *Scombridae*. Lowe also, for several reasons which he sets forth in detail, considered himself justified in separating his oceanic fish from the better known Mediterranean *Tetragonurus cuvieri*, and he accordingly called it *T. atlanticus*, by which name he subsequently figured it in his Fishes of Madeira, p. 129, f. 19.

With neither of these opinions of Lowe does Dr. Günther (Cat. Fish. iii., p. 408) agree, for, in the first place, he considers that *T. atlanticus* has not been proved to be specifically separable from *T. cuvieri*; and, in the second place, he establishes a distinct group of the *Atherinidae* under the name of *Tetragonurina* for the sole reception of this genus, thus more or less endorsing the opinions of the earlier writers in regard to its relationship with the Grey Mullet, and in fact almost exactly replacing it in the position assigned to it by Risso in his later work.

Dr. Günther further remarks that "it will always be valuable, in so scarce a fish, to note peculiarities of the single individuals which are preserved in our collections." Acting on this suggestion we therefore, on the Hon. William Macleay with great liberality presenting his type specimen to the Australian Museum, applied to Prof. Giglioli, of Florence, for an example of the Mediterranean form, which with his usual promptitude he forwarded, and we received safely during last September.

In the mean time, the expedition which had been sent by the Australian Museum, under the command of Mr. Robert Etheridge, to make collections on Lord Howe Island, had the good fortune to obtain from Mr. Campbell Stevens, a member of the police force there stationed, a second example of Mr. Macleay's fish, which, like the first, had been washed ashore dead. From these two Pacific examples we have drawn up the following detailed description :—

TETRAGONURUS WILKINSONI, Macleay.

B. V. D. 15/13. A. 1/11-12. V. 1/5. P. 16. C. 18. L. 1. 112-115. L. tr. 10/20.

The length of the head is from four and a third to four and a half, the height of the body immediately behind the pectoral fin seven and a fifth in the total length. The eye is large, the greater part of it situated in front of the middle of the head; it does not encroach on the upper profile, and its diameter is three and two-fifths in the length of the head, while it is equal to the length of the snout, which is obtuse, and whose upper profile is slightly convex. The interorbital space is flattened, and has a low median longitudinal ridge which commences between the posterior nostrils and terminates in a light colored bony knob between the posterior margins of the eyes; its width is four-fifths of the diameter of the orbit, which is but little greater horizontally than vertically. The breadth of the body immediately above the base of the pectoral fins is five-sevenths of its height. The jaws are equal, with the cleft of the mouth oblique and of considerable size, the maxilla extending backwards to or but little beyond the anterior margin of the orbit. The edges of the opercular bones are armed with minute denticles.

The teeth in both jaws are covered almost to the very tips with a gum-like coating, which being removed shows that they are arranged in a single row, are distinctly separate though placed close to one another, number in the maxilla—where they are much more distant than in the mandible—twenty-five on each

ramus, and on the mandible about forty-four, and are long, slender, compressed and slightly bent backwards at the extreme tip. The vomerine and palatine bones are armed with a distinct row of conical teeth, which are a little curved and strongly inclined backwards from the very base, the anterior four or five in each row standing on an appreciably higher level than those succeeding them, while the vomerine row extends rather further back than those on the palatine bones; along either of the raised edges of the tongue is a row of similar but smaller teeth.

The dorsal fin commences opposite the middle of the pectoral, and on the thirteenth series of lateral line scales; the distance between its origin and the tip of the snout being contained three and a quarter times in the total length: the spines are low and somewhat feeble, the longest, which is between the third and sixth, being about two-thirds of the diameter of the eye; each spine is joined by a delicate membrane to the lower third of its successor, except in the case of the last two or three minute and almost hidden spines which stand alone: the first dorsal ray rises from the forty-third series of lateral line scales, the last from the fifty-eight, its distance from the root of the caudal being nine-tenths of the length of the head; the rays are delicate, and the highest is but three-fourths of the body below it. The anal fin commences beneath the fifth dorsal ray, and ends nearer to the caudal than does that fin, so that the distance between its last ray and the base of the caudal is only four-fifths of the length of the head. The ventral fin commences a little behind the base of the pectoral, and is very small, its length being about equal to one diameter of the eye. The pectoral fin is placed low down on the side of the body, the upper angle of its base rising at a considerable distance below half the height of the body at that spot, and being but a short distance behind the margin of the opercle, which however it does not touch; it is pointed and short, from three-fifths to four-sevenths of the length of the head, and about seven and two-fifths in the total length. The caudal fin is deeply forked, and is about one-eighth of the total length the lobes being rounded. The rays of all the fins are excessively fragile.

The free part of the tail is much depressed and compressed, forming an almost perfect square, its height being equal to or but little more than its breadth immediately before the base of the caudal fin, and all four sides being slightly concave. On each side of the posterior part of the tail there are two strong keels, which converge behind.

The scales are set in regular oblique rows, each of which is slightly curved backward at its dorsal extremity, and strongly forwards on the lower half of the body, thus forming a gracefully sigmoidal band. They are small and firmly adherent laterally, each scale slightly overlapping that one which lies next below it on its own row, and to a less extent its corresponding scale on the succeeding row. Each scale bears seven or eight visible longitudinal keels, and each of these is again armed with four or five denticles, and terminates in a strong spine.

The lateral line is slightly curved along its anterior half, and consists of one hundred and twelve to one hundred and fifteen scales, which are slightly raised above those adjoining them, and about twenty of which are minute and lie between the caudal keels.* The transverse series which rises at the base of the first dorsal ray bears thirty scales, counting obliquely forwards to the middle of the abdomen, ten of these being above the lateral line.

The color is of an uniform dark brown : the roof of the mouth is black, the inside of the jaws bright yellow.

Before comparing these two specimens with the descriptions of previous authors, and with our own Mediterranean example, we must call particular attention to the fact that the two above described are small, measuring but a fraction over seven inches each, while Lowe's was nine and a quarter, and the specimen in spirits examined by Dr. Günther in 1861 twelve and a half inches, our example from the same locality as that last mentioned being thirteen and a half inches, and it is possible that these differences in size may account for the undoubtedly great discrepancies in the comparative measurements.

* Hence the ninety lateral line scales of Lowe and Macleay.

Comparing first our Mediterranean specimen with the above description, we find the following differences, which great as they may appear, must be judged, as before mentioned, in a great measure by the size of the individual example.

The length of the head is five and three-quarters, the height of the body* seven and two-thirds in the total length. The eye is small, situated entirely in front of the middle of the head, and its diameter is five and one-third in the length of the head, and but three-fifths of that of the snout. The interorbital space has no longitudinal ridge, but the bony knob on the occiput is present. The breadth of the body is five-eighths of its height. There are thirty-six maxillary, and fifty-three mandibulary teeth in each ramus. The other teeth are very much the same except that the vomerine band does not extend so far back as those on the palatine bones, and on both all the teeth rise from the same level. The dorsal fin commences at a considerable distance behind the pectoral, and, on the twenty-first series of lateral line scales, the distance between its origin and the tip of the snout being contained three and a-third times in the total length; as might be expected the longest spine is equal to the diameter of the eye. The first dorsal ray rises from the fifty-sixth series of lateral line scales, the last from the seventy-fourth, its distance from the root of the caudal being considerably more than the length of the head; the longest ray is three-fifths of the height of the body below it. The ventral fin commences far behind the base of the pectoral, and is much longer than the eye. The pectoral fin is but half the length of the head, and eleven and two-thirds in the total length, the caudal one-ninth of the same. The breadth of the free portion of the tail is three-fourths of its height. The lateral line consists of one hundred and twenty-two scales.

If we now compare this latter short description with Dr. Günther's description of a Mediterranean example—undoubtedly of the same species as ours—we find the head and eyes in his

* In all cases the measurements of this fish have been taken at the corresponding spot to that specified in the earlier description.

specimens even smaller comparatively, the teeth much fewer in number, and in our specimen only a few of the dorsal spines—third to sixth—equal to the diameter of the eye, those behind them becoming gradually shorter, but, like the Lord Howe examples, there is a distinct membrane joining each pair of spines, with the exception of the last few.

Referring to the scales, Dr. Günther says "each is deeply striated, with five or six keels, each keel terminating in a minute point;" our Mediterranean specimen has seven or eight visible keels, each ending in a point, but with evident indications of having been spinate along their whole length, these however having almost disappeared with age.

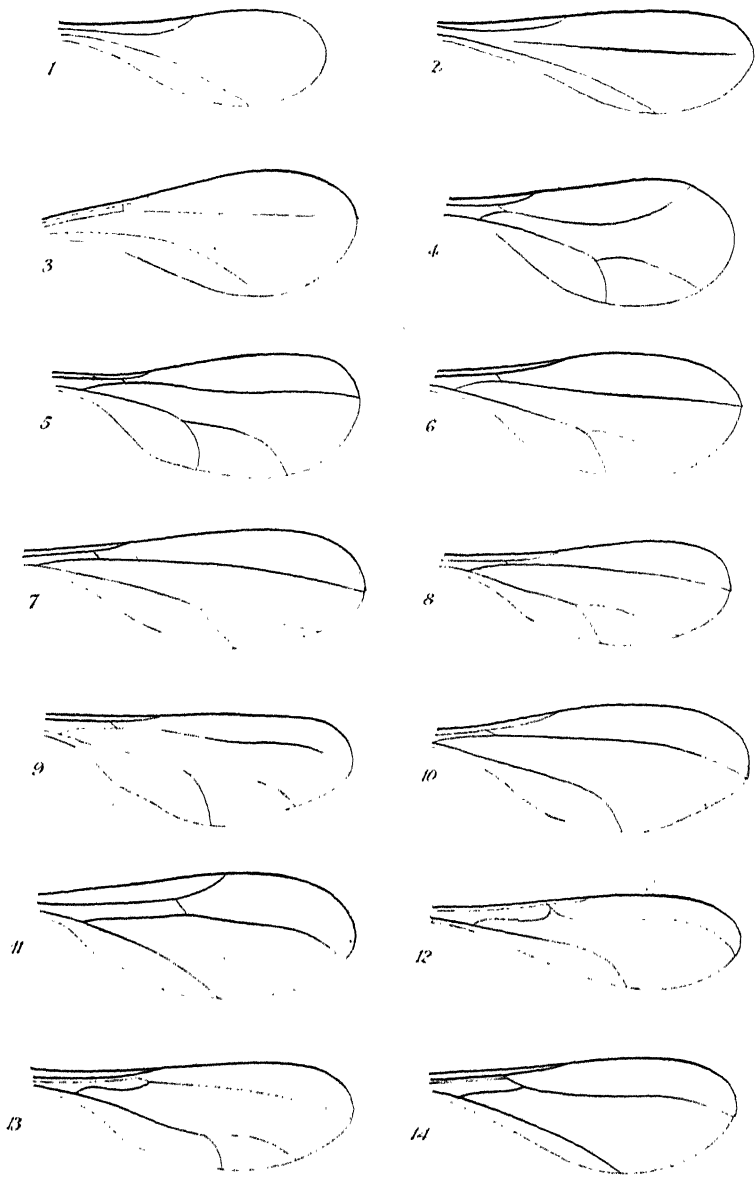
It is, however, evident that the discrepancies between Dr. Günther's and our description are not of such magnitude as to cause any doubt of their specific identity, and this species is therefore the true *Tetragonurus cuvieri* of Risso.

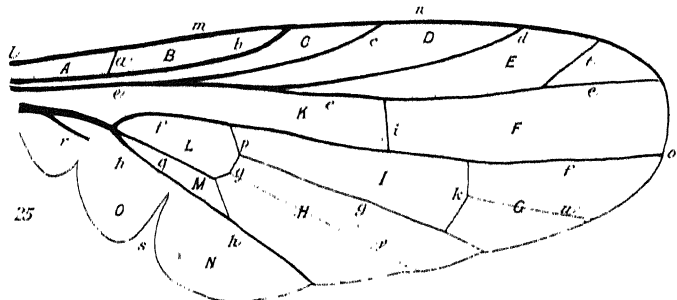
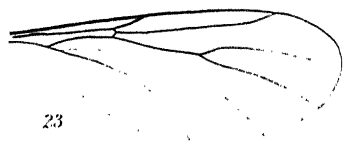
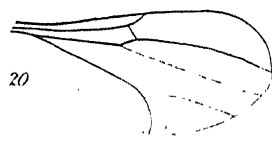
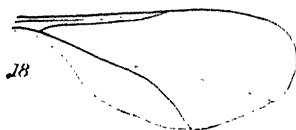
We have now however to compare our Pacific specimens with Lowe's detailed description of his Atlantic one, taken off an island of very similar formation to Lord Howe Island, and we must again draw attention to the fact that his specimen is exactly intermediate in size between ours and Dr. Günther's, and we should therefore expect to find the comparative measurements also intermediate.

This, however, is not the case, as in almost every particular the specimens are absolutely identical, the slightly more forward position of the pectoral fin in Lowe's fish, and its smaller comparative size, together with the more numerous maxillary teeth constituting differences hardly worthy of mention.

Judging from these data we are therefore of opinion that it is impossible to separate the Pacific from the Atlantic form, and that until specimens intermediate between these and the Mediterranean fish have been examined by a competent authority in the light now thrown on the subject by this paper, we cannot endorse the opinion that the oceanic form is identical with that of Risso.

We would hardly be justified in leaving this interesting subject without making some remarks on the position of *Tetragonurus* in the ichthyological system, though, from want of sufficient specimens, being unable to spare one for dissection, we cannot speak authoritatively on this point ; we are however distinctly of opinion that it cannot be kept among the *Atherinidae*, and indeed that its relationship to the Grey Mulletts is, to say the least, doubtful : we agree with Risso that it is well entitled to family rank, and we think that its position will eventually prove to be closer to the Colto-scombriform Acanthopterygians than to the Mugiliform ; as however this opinion has necessarily been taken entirely from external characters we do not expect that much value will be attached to it, still we feel that writing on the subject of so little known a fish we should be remiss in not recording our opinion, provisional though it may be, against that which would place this species, so unique in the formation of its scales and teeth among the Mugiliform fishes.





DIPTERA OF AUSTRALIA.

By FREDERICK A. A. SKUSE.

PART I.

(Plates II. and III.)

Up to the present time very little has been done towards a knowledge of the Australian Diptera, and this, for more than one reason, is not so remarkable as may at the outset appear. Firstly, to properly work-up any order in the insect fauna of any country, or even any locality, it is absolutely essential that the entomologist should be on the spot, and his observations, to be of value, must necessarily be the result of extended investigations; but not a single species of Diptera of this country has ever been described here. If the entomologist be thousands of miles away he can only deal with shrunk or otherwise altered specimens, besides being quite unable to search out the habitats and study the habits of the species; whereas if these be taken account of the results are eminently more interesting and valuable than the mere descriptions of dried specimens. Secondly, the fragility of some and the smallness of many have not induced *collectors* working amidst a profusion of insects of greater size and more attractive appearance (at the same time readily stored and demanding only a *minimum* of trouble) to concern themselves about Diptera. Thirdly, the few entomologists that there are in this country have found, and still continue to find, so much to do amongst the larger and more easily handled insects which generally excite the first attention. Lastly, the undertaking is one not unaccompanied with great difficulty and liability to blundering; and to successfully commence and prosecute this study, the student must be endowed with considerably more than a mean *quantum* of patience

and perseverance, and, moreover, be prepared to devote particular and exclusive attention to his subject. There are some entomologists, however, who are not disposed to entirely concentrate their attention on a single order, though even a genus alone would possibly entail ample employment for an average lifetime.

In 1864 the total number of known Australian Diptera was estimated by Dr. Schiner at 1056 species, including many collected by Mr. Frauenfeld in the neighbourhood of Sydney during the "Novara" expedition. Since that time very few have been added. A considerable number out of the total have been described by Walker in the British Museum Catalogues, but it is doubtful if many of the descriptions will prove of the slightest value. I believe the same author also in the year 1856 described several in the "Insecta Saundersiana," a work privately printed, now scarce and out of print, and which I have been unable to see. A large number were described by Macquart in his "Diptères Exotiques nouveaux ou peu connus," and its five supplements appearing between 1838 and 1855; but the descriptions are drawn up carelessly, and most of them are little better than those of Walker. There are besides these, other descriptions of detached species by various authors. Our acquaintance then with the Dipterology of this Continent is in a most unsatisfactory condition; the descriptions are scattered and many of them worthless; and, far from advancing science, are calculated to create nothing but disorder.

The present paper is the first contribution towards a work on Australian Diptera, in process of preparation by myself, to appear from time to time in monographs of families. The materials will be derived principally from the rich collection of the Hon. William Macleay, in which I hope the types of all species I shall describe will be found, as it would be of great value for reference, with other advantages, to have all the types contained in one great central collection; but this need not dissuade correspondents from lending me specimens for description. I hope to add largely to the number by my own collecting, particularly among the Cecidomyiidae and other

small kinds. All the Cecidomyidæ described in this paper have been collected by Mr. Masters and myself, chiefly in the environs of Sydney; but we have made numerous excursions to the Blue Mountains, the Hawkesbury district, the Illawarra district and other parts, all, with a single exception, within 40 miles of Sydney. It would have been difficult not to discover new species, for only three had been previously described;* but I was surprised to find such an abundance of forms, as it has taken only a very short time to bring the total up to 95. This I believe to be only a small fraction of the species of the group occurring in an exceedingly limited area; the number inhabiting New South Wales, not to say the whole of Australia, must be enormous. Other families seem correspondingly to abound in species, and, judging from the comparative abundance of this and other large orders of insects, the Diptera of Australia cannot I think fall short of ten thousand.

I much regret that with my descriptions of the gall-gnats I have been able to add the life-history of but a solitary species, and that only imperfectly. Although I regard the descriptions of little value apart from the observation of the habits of the insect, especially in its larval state, I do not think that should deter me from making this commencement, or from publishing what I have; for I hope that, when once a start has been made, it may induce others, who will now be enabled to form some conception of the amount of work there is to be done, to take an interest in the subject, and to come forward to aid in its elucidation. To determine the life-history of each species of the gall-gnats I now describe, means a considerable amount of careful work, and may take me some time. I should be very glad to receive specimens of Diptera, or portions of malformed plants possibly infested with the larvæ of Cecidomyidæ, from all parts of the country, and hope that members of this and other similar scientific societies will do all in their power for the furtherance of this interesting branch of natural history. The following directions if properly carried out are

*In "Reise der Novara" Dipt. by Dr. T. R. Schiner.

sufficient for the collection and preservation of Diptera. The larger species I generally capture with a small bag-net made of very fine silk gauze, and the smaller ones by means of a glass tube charged with chloroform or benzole. The tube is prepared in the following way :—a piece of cotton-wool moistened with one of the above is inserted into the end of the tube, pressed tightly down, and covered by a circular piece of blotting-paper. Of course when not in use the tube is kept corked. When a large insect has been captured in the net, take one of the chloroform tubes and secure the insect in it against the side of the net; then, with a little manipulation it is easy to put in the cork, and the insect dies almost instantly. Having left it there for a short time it is taken out and pinned in a cork-bottom collecting box, and there is no further trouble with it; but unless specimens are afterwards carefully kept in a tight box provided with a lump of camphor they will speedily be destroyed by mites or some of the small beetles prejudicial to natural history collections. In using the glass-tube for capturing, the insects must always be at rest, and as they may be commonly thus found under the ledges of overhanging rocks, on logs, and in similar situations, it is generally an easy matter to place the mouth of the tube gently over them; they will immediately fly up the tube which must then be quickly corked. When resting on a flower or a leaf the palm of the hand may be employed^a to inclose the insect within the tube. Should the inside surface of the tube be at all damp it is necessary to uncork and expose it for a few seconds to the drying influence of the atmosphere, otherwise, enclosed insects, especially if they be very minute, are liable to adhere to the glass, and their wings and antennæ to be spoiled. As soon as the insects are dead they must be transferred to a pill-box, and carefully placed between layers of soft fresh leaves or petals of flowers, so as to prevent shaking, while the moisture from the leaves will prevent them from becoming brittle, and thus liable to get broken. On reaching home they should be at once unpacked and neatly gummed on small pieces of card, and pinned through the latter. A slight dot of gum will suffice. The insects should

be lifted on to the gummed card with a needle, great care being taken not to touch the wings with the gum. When insects are sent through the post they must on no account be placed in fragile boxes, and must always be firmly pinned, otherwise they may be destroyed before reaching their destination. The box should be light and at the same time as strong as possible, lined with cork at the top and bottom. Having securely pinned the specimens the box should first be tightly tied, and then well wrapped in cotton wool or some similarly soft material before being eventually carefully enveloped and tied up in thick paper. The address and postage stamps should be placed on a label attached by string to the package, but on no account must they be put on the wrapper of the box, as the process of obliteration pursued by the postal authorities is likely to be attended with a disastrous result as far as the contained specimens are concerned.

I wish here to cordially thank the Hon. William Macleay, who has done all in his power to facilitate my work, and also Mr. Masters, whose aid in the collection of specimens has been very considerable.

The writings of Baron R. Osten-Sacken, Prof. Loew, and Mr. Winnertz have given much information as to the classification and life-history of the Cecidomyiidae, and I desire to freely acknowledge the great help I have obtained from these and many other older authorities. Unfortunately my resources have not included Dr. Schiner's *Fauna Austriaca, Diptera*, therefore I have been unable to avail myself of the mass of valuable information therein contained.

At the head of the descriptions of Cecidomyiidae described for the first time in this paper, I have given micrometrical measurements of the antennae, wings, and bodies of what I consider average-sized specimens, in thousandths of an inch, and corresponding fractions of a millimètre.

The following table will show approximately the system of classification of the families I propose to adopt, founded more or less on that of Brauer and Schiner:—

Section I. DIPTERA ORTHORHAPHA.

Division I. NEMATOCERA.

Sub-division 1. *Oligoneura*.

Fam.—Cecidomyiidae, Sciaridae, Mycetophilidae, Simuliidae, Bibionidae.

Sub-division 2. *Polynoeura*.

Fam.—Blepharoceridae, Culicidae, Chironomidae, Orphnephilidae, Psychodidae, Tipulidae, Dixidae, Rhyphidae.

Division II. BRACHYCERA.

Sub-division 1. *Cyclocera*.

Fam.—Xylophagidae, Ctenomyiidae, Stratiomyidae, Acanthomyiidae, Tabanidae.

Sub-division 2. *Orthocera*.

Fam.—Leptidae, Asilidae, Midasiidae, Nemestrinidae, Bombyliidae, Therevidae, Scenopinidae, Cyrtidae, Empidae, Dolichopodidae, Lonchopteridae.

Section II. DIPTERA CYCLORHAPHA.

Division I. PROBOSCIDEA.

Fam.—Syrphidae, Myopidae, Conopidae, Pipunculidae, Platypezidae, Oestridae, Tachinidae, Dexidae, Sarcophagidae, Muscidae, Anthomyiidae, Cordyluridae, Helomyzidae, Sciomyzidae, Psilidae, Micropezidae, Ortalidae, Trypetidae, Lonchæidae, Sapromyzidae, Phycodromidae, Heteroneuridae, Opomyzidae, Sepsidae, Diopsidae, Piophilidae, Ephyridae, Geomyzidae, Drosophilidae, Oscinidae, Agromyzidae, Phytomyzidae, Asteidae, Borboridae, Phoridae.

Division II. EPROBOSCIDEA.

Fam.—Hippoboscidae, Nycteribidae.

Order DIPTERA.

Wings two ; mesothoracic, membranous, with radiate veins ; posterior wings wanting, represented by a pair of small clavate filaments called halteres ; mouth suctorial ; metamorphosis perfect ; larva apodal ; pupa inactive.

Section I. ORTHORHAPHA.

The pupa case opening longitudinally.

Division I. NEMATOCERA.

The flies belonging to this division are characterised by the possession of long thread-like antennæ consisting of several joints, in many instances beautifully ornamented with whorls of long delicate hairs, especially in the males ; nearly all are to be recognised without much difficulty by their long slender body and limbs, small rounded head, and elevated thorax ; and as typical examples might be mentioned the familiar Mosquitoes (Culicidæ) whose blood-sucking propensities are only too well-known, the Daddy-longlegs (Tipulidæ), and the swarms of Midges (Chironomidæ, Cecidomyidæ, &c.). They are to be found especially in damp and shady situations, and are to be met with abundantly in all regions presenting these essential conditions of their existence ; but there is, nevertheless, in these insects, a considerable variety both of character and habits ; those latter will be fully considered as we come to deal with each family separately in future papers, though it will be well to here give a preliminary sketch of them.

The NEMATOCERA, formerly regarded as divisible into only two families, is now split up into thirteen.

Fam. I.—CECIDOMYIDÆ (Gall Midges). *Characters*: Small delicate species ; antennæ long, necklace-like ; often no ocelli ; legs very long, slender ; coxæ short ; tibiæ slender, without spurs ; wings well haired, with very few veins.

Hab.—In their preparatory states generally inhabiting gall-like excrescences formed by them on certain parts of living plants, but also found in rolled leaves, in decaying wood, under bark, etc.; perfect insect frequently common in caves and shady places.

Fam. 2.—*SCIARIDÆ* (Shade Midges). *Chars.* Generally small; antennæ moderately long, curved, with cylindrical bead-like joints; ocelli three; legs long, slender; the tibiæ with or without spurs; wings often dark, their venation approaching that of the last family.

Hab.—The larvæ and pupæ found under the bark of logs or felled trees, or at the roots of decaying plants; the former of one species have received the name of Army-worm (*Heerwurm*), from the habit of congregating in large numbers and travelling together in a body; perfect insect generally abundant in forests or well-wooded districts.

Fam. 3.—*MYCETOPHILIDÆ* (Fungus Midges). *Chars.* Some small, others of very moderate size, and sometimes with beautifully marked wings; ocelli three or two; antennæ short; proboscis short; legs long; coxæ elongated; tibiæ spurred; wings without discoidal cell; venation more elaborate than in the two preceding.

Hab.—The larvæ living chiefly upon fungi, wood detritus, or decaying vegetable matter; some spin a silken web within which they live; perfect insect very active, capable of leaping; found in damp situations.

Fam. 4.—*SIMULIDÆ* (Sand-flies). Containing only one genus. *Chars.* Individuals of small size; antennæ cylindrical; ocelli none; all parts of the mouth fully developed; legs short; hind tibiæ and first joint of the tarsi broad; tibiæ without spurs; wings broad, rather indistinctly veined.

Hab. Larvæ living in the stems of aquatic plants, to which they finally attach cocoons; perfect insect capable of inflicting painful wounds; swarming generally in the vicinity of marshy places.

Fam. 5.—*BIBIONIDÆ*. *Chars.* Moderately sized; body and legs shorter and more robust than in the species of the other families; antennæ short; ocelli three; prothorax large; wings large.

Hab.—Found, in their preparatory states, in the ground, or in dung ; perfect insects often with a sluggish flight ; common on flowers.

Fam. 6.—BLEPHAROCERIDÆ. *Chars.* Small ; antennæ long and slender ; eyes contiguous or non-contiguous, alike in both sexes ; ocelli three ; legs long ; coxæ short ; posterior tibiæ generally with strong spurs ; wings broad and long, in venation approaching the Mycetophilidæ.

Hab.—Very little is known about the habits of these species ; a Brazilian example, according to Dr. Müller, exhibits a strange form of female dimorphism. The male lives on flowers, so also does one of the females ; but the other, like the female mosquito, is provided with a long proboscis, and sucks the blood of animals.

Fam. 7.—CULICIDÆ (Mosquitoes). *Chars.* Very slender, moderately sized ; antennæ long and slender ; proboscis in the female containing all the parts found in any Dipterous insect ; ocelli none ; thorax stout ; legs long and slender ; wings slender ; veins more than six in number in some.

Hab.—Eggs deposited in water ; larvæ found abundantly, swimming with a peculiar jerking motion in ponds and ditches ; perfect insect abundant in the neighbourhood of water. It is only the females that feast upon the blood of animals ; the males feed only on vegetables ; they are very fond of the honey of flowers, to which also the females are attracted.

Fam. 8.—CHIRONOMIDÆ (Midges). *Chars.* Small ; antennæ slender, beautifully adorned with hairs ; proboscis fleshy ; ocelli obsolete ; abdomen and legs long and slender ; wings slender, the veins very similar to those of the gnats.

Hab.—The larvæ and pupæ of some are aquatic ; some others live in dung or under bark ; perfect insect common in the neighbourhood of water ; some, like the Culicidæ, have the power of inflicting wounds in animals.

Fam. 9.—ORPIINEPHILIDÆ. Only a single genus. *Chars.* Small insects ; antennæ short ; ocelli absent ; proboscis little projecting ;

thorax elevated ; legs rather short ; wings long and narrow ; veins uniformly distinct.

Hab.—Very little is known. *Orphnephila testacea*, the type of the family, is said to be found in bakehouses.

Fam. 10.—*PSYCHODIDÆ* (Moth Midges). *Chars.* Very small flies ; antennæ rather long, whorled with hairs ; ocelli none ; body clothed with long coarse hair ; legs rather long ; tibiæ without spurs ; wings broad and hairy, with many longitudinal veins.

Hab.—Larvæ living in fungi and rotten vegetable matter ; perfect insect frequently occurring on walls and windows ; some at least are capable of jumping.

Fam. 11.—*TIPULIDÆ* (Daddy-longlegs). *Chars.* The largest flies of the division, if not of the order ; antennæ long and thread-like, furnished with long hairs, or pectinated ; almost all without ocelli ; proboscis fleshy, rather prominent ; thorax with a V-shaped transverse suture ; legs extremely long and fragile ; tibiæ often spurred at the tip ; wings long, with a very complete venation ; discoidal cell present in most cases ; basal cells very long.

Hab.—The larvæ live in the ground, in rotten wood, in fungi, on the leaves of plants, or in water, etc. ; pupæ found in the same situations ; imagines frequenting water, damp situations, flowers, etc., and often to be found in caves or under overhanging rocks.

Fam. 12.—*DIXIDÆ*. *Chars.* Small gnats ; antennæ long ; ocelli wanting ; proboscis rather prominent ; body slender ; legs long and slender ; wings somewhat large, occasionally spotted ; six longitudinal veins ; discoidal cell wanting.

Hab.—Larvæ aquatic ; perfect insects congregating in swarms in damp wooded localities.

Fam. 13.—*RHYPHIDÆ*. Only a single genus. *Chars.* Moderate-sized flies ; antennæ moderately long ; ocelli three ; legs rather long and slender ; wings large and broad, with a discoidal cell.

Hab.—Larvæ feeding on rotten vegetable matter, cow-dung, etc. ; perfect insects often seen on the walls of outdoor closets and sheds, or in caves, and other damp places.

KEY TO THE FAMILIES OF NEMATOCERA.

A. Thorax without any transverse suture.

a. Tibiæ not spurred.

* Wings haired.

Longitudinal veins few.....*Cecidomyiidae*. 1.Longitudinal veins numerous.....*Psychodidae*. 10.

** Wings naked.

§ No ocelli.

1. Legs long; antennæ with more than 12 joints.

Costal vein continued round the
margin of the wing.....*Culicidae*. 7.Costal vein terminating near the
tip of the wing.....*Chironomidae*. 8.

2. Legs rather short; antennæ short.

Costal vein continued round the
posterior border.....*Orphnephilidae*. 9.

3. Legs short; antennæ with less than

12 joints.....*Simuliidae*. 4.

§§ Ocelli.

No discoidal cell.....*Bibionidae*. 5.A discoidal cell.....*Rhyphidae*. 13.

b. Tibiæ spurred.

† Ocelli.

Anterior tibiæ spurred.....*Blepharoceridae*. 6All tibiæ spurred.....*Mycetophilidae*. 3.With or without spurs*Sciaridae*. 2.

†† No ocelli.

All tibiæ spurred.....*Dixidae*. 12.B. Thorax with a V-shaped suture.....*Tipulidae*. 11.

TERMINOLOGY.

Under this heading I shall include those technicalities employed in the descriptions of Diptera, both exclusively or in a more or less modified sense; it is very necessary that I should state

them, more particularly as the terminologies of any two authors are unfortunately only rarely alike. Throughout the following work I shall adhere to the terms adopted by Baron Osten-Sacken and Prof. H. Loew in their masterly monographs of the Diptera of North America, regarding it, in the words of the latter, as the "duty of a later author to accommodate himself to the usages of his predecessors, especially those who have written standard works," that is, as far as it lies in his power. The following, then, is for the most part taken from the first volume of those monographs, by Prof. Loew.

1. *The Head.*

The back of the head opposite to the thorax is the *occiput*, and is prominently perceptible in both Diptera and Hymenoptera carrying their heads free; that portion of it lying over the attachment of the head is the nape (*cervix*). The front, forehead, or brow (*frons*) is that part of the head stretching from the antennæ as far as the occiput, and is limited laterally by the compound eyes. The crown (*vertex*) is the upper part of the head, upon which frequently are the simple eyes (*ocelli*), generally three in number. The limit between the occiput and the front is styled the vertical margin (*margo verticalis*). Most of those Diptera undergoing their metamorphoses within the larva-skin possess, immediately above the antennæ, an arcuated impressed line, which seems to separate from the front a small, usually crescent-shaped, piece, termed the frontal crescent (*lunula frontalis*); the impressed line, which continues over the face nearly as far as the border of the mouth, is called the frontal fissure (*fissura frontalis*). When the eyes meet on the front so as to divide it into two triangles, the superior one is called the vertical triangle (*triangulum verticale*), the inferior the frontal triangle (*triangulum frontale*). The anterior portion of the head reaching from the antennæ to the border of the mouth or oral margin (*peristomium*) is the face (*facies*). The antennæ are separated into two series of joints; the first, consisting of the two basal joints, called the joints of the *scapus*, and the following

those of the *flagellum*. Beneath the antennæ there are sometimes found longitudinal furrows (*foveæ antennales*) for their reception. The sides of the head, from the eyes downward, are called cheeks (*genæ*). A somewhat swollen ring sometimes surrounds or partly encompasses the compound eyes, and is termed the orbit (*orbita*), the successive parts of which are called the anterior (*orbita anterior sive facialis*), inferior (*inferior s. genalis*), posterior (*posterior s. occipitalis*), superior (*superior s. verticalis*), and frontal (*frontalis*) orbits. Where no such ring is visible, a distinct colour or some peculiar structure marking the nearest surroundings of the eyes is described as an orbit. We will now pass on to the mouth (*os*). The oral parts employed for sucking are called the sucker or proboscis (*proboscis*); when attached to a long and generally cylindrical prolongation of the head, this part is called the snout or rostrum (*rostrum*), and must be distinguished from the latter organ. They may project from a wide aperture often occupying a great part of the under surface of the head, called the mouth-hole (*cavitas oris*). The common fleshy root of the oral parts is connected by a membrane with the border of the mouth. This membrane often has a fold, sometimes almost corneous, and is then called the clypeus or shield (*clypeus s. prelabrum*); it is either entirely concealed by the anterior border of the mouth and is then usually movable, or it projects over it as a ridge and is then usually immovable. Generally the largest of the mouth-parts is the fleshy under lip (*labium* or *hypostoma*), made up of the stem (*stipes*) and the knob (*capitulum labii*) formed by the two suctorial flaps (*labella*). Close by are to be seen the palpi (*palpi*), which are important to notice, being frequently very characteristic. The tongue (*lingua*), under jaws (*maxillæ*), upper jaws (*mandibulæ*), and upper lip (*labrum*), are not only inconspicuous, but generally difficult to determine, and rarely of value in distinguishing species.

According to Meinert (Ent. Tidskr. i. pp. 150-153) the mouth consists of the *pharynx*, which is divided into two portions, the *epipharynx* and the *hypopharynx*. This is followed by the first

metamera, the upper portion of which, combined with the *epipharynx*, forms the *labrum*; its lower part is generally separated from the *hypopharynx*, and forms the *labium*. Behind this is the second *metamera*, that of the *maxillæ*, and the *maxillary lobes* are simply processes of it, and not jointed organs; the *maxillary palpi* are generally similar, only being jointed to the *metamera*, and themselves articulated in *Culex* and *Tipula*. The third and last *metamera*, that of the mandibles, is generally separated from the preceding, though its hinder part is strongly soldered to the cephalic plate: it is, however, never exposed.

II. *The thorax.*

The *mesothorax* is very largely developed in this order, being so much larger than the *prothorax* and *metathorax* that it forms the greatest part of this division of the insect's body; on account of this it is designated the thorax, while different names are bestowed upon characteristic parts of the *prothorax* and *metathorax*. The former frequently forms a neck-like prolongation which bears the head, and is then called the neck (*collum*). In some cases the fore corners of the mesothorax or the shoulders (*humeri*) are covered by a lobe of the prothorax (*lobus prothoracis humeralis*), distinctly separated from the mesothorax; if this lobe be so soldered to the mesothorax that it is impossible to detect a distinct limit between them, except in general by their colour or hair, it is styled the shoulder callosity (*callus humeralis*). When the prothorax applies closely to the anterior border of the mesothorax, it has then the name of collar (*collare*). An important character, in its presence or absence, is a transverse furrow (*sutura transversalis*) frequently found crossing the middle of the upper side of the mesothorax, and terminating on each side just before the base of the wing. On each side of the breast—the breast side (*pleura*)—there is beneath the shoulder a spiracle (*stigma prothoracis*).

The scutcheon (*scutellum*) is separated from the back of the mesothorax by a furrow, and is situated between the wings. A part of the metathorax is to be seen beneath the scutellum, called the *metanotum*; this is generally found descending obliquely, often very convex, and on each side with a more or less inflated

space, called the lateral callosity of the metanotum (*callus metanoti lateralis*). The poisers or balancers (*halteres*) have their origin beneath this callosity, and in front of each of them we see the spiracle of the metathorax (*stigma metathoracis*). The membranous covers sometimes found above this spiracle have the name of covering scales (*tegulæ* or *squamæ*).

III. *The abdomen.*

The upper side is generally so called, the name of belly (*venter*) being applied to the under side. The terminal joint is furnished in the male with appendages destined to take hold of the female *in copulâ*, and if they partake of the form of pincers and are not bent under the body these are called *forceps*; in the female with the organ for laying eggs (*ovipositor*), which may either be called the borer (*terebræ*) or the style (*stylus*), depending on its shape.

IV. *The wings.*

A precise nomenclature of the veins and cells of the wings is of the utmost importance; their existence and mutual arrangement afford the most valuable criteria in the systematic distribution of the order, and in the definition of the species. Dr. Schiner (Verh. z-b. Gesellsch. in Wien, Band XIV.) has proposed a new, and, in many respects, excellent nomenclature for the veins and cells of the wings in the Diptera; but I prefer to fall back upon that of Prof. Loew, which preceded the other by two years, and at the same time adequately fulfils its purpose.

As pointed out by Prof. Loew, the venation of the wings throughout all the Diptera occurs merely as modifications of a common type, and that type is to be found amongst the Muscidæ. For illustration, however, he selects three wings, one from the Ortalidæ (*Ortalis*), the second from the Empidæ (*Empis*), and the last from the Asilidæ (*Dasypogon*), from which three he can deduce the whole plan of venation, and consequently the cellular system. As an endeavour to simplify matters I will combine in a single diagram the wings referred to, and form an ideal typical wing, thus enabling me to tabulate six or seven pages of Prof. Loew's

letterpress. From this we shall be able afterwards without much difficulty, to interpret correctly any incomplete venation, which, as he intimates, is often by far more difficult of correct understanding than a very intricate example.

VEINS.*

Primarily we have six longitudinal veins issuing from the two main trunks, three from the first and three from the second; all the remaining venation springs from them.

- a. Transverse shoulder-vein (*vena transversa humeralis*).
- b. Auxiliary vein (*vena auxiliaris*).
- c. First longitudinal vein (*vena longitudinalis prima*).
- d. Second longitudinal vein (*vena longitudinalis secunda*).
- e. Third longitudinal vein (*vena longitudinalis tertia*).
- f. Fourth longitudinal vein (*vena longitudinalis quarta*).
- g. Fifth longitudinal vein (*vena longitudinalis quinta*).
- h. Sixth longitudinal vein (*vena longitudinalis sexta*).
- i. Small or middle transverse vein (*vena transversa minor s. media*).
- k. Hinder transverse vein (*vena transversa posterior*).
- l. }
m. }
n. } Costal vein (*vena costalis*).
o. }
- p. Anterior basal transverse vein (*vena transversa basalis anterior*).
- q. Posterior basal transverse vein (*vena transversa basalis posterior*).
- r. Rudiment of a fourth trunk.
- s. Axillary incision (*incisura axillaris*).
- t. Anterior branch of the third longitudinal vein (*venae longitudinalis tertiae ramus anterior*).
- u. Anterior intercalary vein (*vena intercalaris anterior*).
- v. Posterior intercalary vein (*vena intercalaris posterior*).

* Letters under this and the next head refer to diagram on Plate III., fig. 25.

Observations.

h. Generally the longest transverse vein of the wing, and of the highest systematic importance.

p. and *q.* Usually present.

p. The absence of this vein is characteristic for some families.

q. Sometimes meeting *h* at a very acute angle or running into the border without having met that vein; in all cases dividing the space between *g* and *h* into two parts.

r. Occasionally giving rise to rudimentary branches or axillary veins (*venæ axillares*), or less frequently to complete longitudinal veins (in the case of such a development, the foremost of the veins is generally connected near its base with *h*, by a transverse vein), still regarded as axillary, but may be numbered as the seventh and (if another) the eighth longitudinal veins.

v. In some cases meets *g* before reaching the margin.

CELLS.

A middle space or band extending from the base of the wing to the tip, separates the three anterior sections divided by the three longitudinal veins belonging to the anterior main trunk, and the three posterior sections resulting from the longitudinal veins of the posterior main trunk; these three sections in each case are styled exterior, middle, and anterior, and may be again divided into smaller cells.

- A. First costal cell (*cellula costalis prima*).
- B. Second costal cell (*cellula costalis secunda*).
- C. Third costal cell (*cellula costalis tertia*).
- D. Marginal cell (*cellula marginalis*).
- E. Submarginal cell (*cellula submarginalis*).
- F. First posterior cell (*cellula posterior prima*).
- G. Second posterior cell (*cellula posterior secunda*).
- H. Third posterior cell (*cellula posterior tertia*).
- I. Discal cell (*cellula discoidalis*).

- K. First or large basal cell (*cellula basalis prima s. major*).
- L. Second basal cell, or anterior of the small basal cells.
- M. Third basal cell, or posterior of the small basal cells.
- N. Anal or axillary corner of the wing (*angulus analis s. axillaris*).
- O. Alar appendage (*alula*).

Observations.

E. Cells here of the utmost importance. When *d* and *e* are simple, there is therefore only one sub-marginal cell; but when *e* has *t*, we count two cells, an anterior and a posterior one; when *t* of *e* is also connected with *d* by a transverse vein, the number of submarginal cells amounts to three; that one formed by the inner part of the anterior submarginal cell is called the anterior sub-marginal cell; when *t* of *e* takes the form of a transverse vein to *d*, only an anterior and an exterior submarginal cell are distinguished.

F. Usually subject to no partition, but sometimes closed before reaching the margin.

G. Frequently divided by the presence of *u*, and this occurs whenever *f* emits a hind branch before its end. When G and I are united in consequence of the absence of *k* the cell thus formed retains the name of G.

I. This is one of the most important cells belonging to the first section of the posterior part of the wing. When *p* is wanting, L is considered part of I. When *u* is present, sometimes the part of *k* before or behind it is wanting, then I is regarded as anteriorly or posteriorly opened, as the case may be.

K, L, and M. The first is generally the longest, and the three are usually spoken of as "one large and two small basal cells," but when *g* is stretched longitudinally so that M joins the border, or it is distinguished from L by a much greater length, though closed, M is termed the anal cell (*cellula analis*).

CLASSIFICATION OF THE CECIDOMYIDÆ.

The term *Cecidomyia* was first applied by Meigen in 1803 to a genus established by him to contain those flies (with the exception of *Lasioptera* and *Clinorhyncha*) now divided into several sub-genera, and placed by Prof. Loew in the section CECIDOMYINA of the family Cecidomyidæ. In 1818 Meigen (Syst. Besch. I.) also instituted the genera *Lasioptera* and *Campylomyza*, placing the three in a tribe denominated *Tipulariæ gallicolæ*; and at this period, those families at present constituting the great division Nematocera, were simply regarded as genera belonging to a single family Tipulariæ. The family name Tipulariæ and the generic *Tipula* were first employed by Linnæus (Syst. Nat.) in 1735, but the study of the gall midges really only dates from about the beginning of the nineteenth century, though Linnæus described four or five as early as 1761; also Fabricius and Shrank described a small number in 1781, all under the name of *Tipula*. Kirby (Trans. Linn. Soc. Lond. 1798) has published a long account of the habits and the metamorphoses of *Tipula tritici*, a renowned enemy of wheat crops, at the present day classified as *Cecidomyia (Diplosis) tritici*.

In 1825 Latreille substituted Nematocera for the old family name Tipulariæ, and he divided the group into two tribes (1) *Culicides* and (2) *Tipulariæ*, the genera *Cecidomyia* and *Lasioptera* being placed in a kind of sub-division, *Gallicolæ*, together with *Psychoda*, &c.; but *Campylomyza* was separated from them and located with flies which now contribute to the family Mycetophilidæ, then called Fungivoræ.

In the year 1828 Wiedemann (Auss. Europ. Zwfl.) adopted the classification of Meigen, but added a species of *Lasioptera*, two of *Cecidomyia*, and a *Campylomyza*, all described by Say from North America a short time previously, including *Cecidomyia destructor* in 1817.

Macquart in 1834 (Hist. Nat. des Insects, Dipt.) converted the tribes *Culicides* and *Tipulariæ* into families, and the latter

was split up into tribes, adopting exactly the same terms employed by Latreille to designate his subdivisions, viz. :—T. Culiciformes, Terricoles, Fongicoles, Gallicoles, and Florales; the fourth of these at the same time stood as follows :—

A. Wings lying horizontally, with a small number of veins.

B. Four posterior cellules; second petiolate.

C. Second posterior cellule narrow at the base.

1st Genus *Lestremia*.

CC. Second posterior cellule very wide at the base.

2nd Genus *Zygoneura*.

BB. Three or four veins only.

D. Three longitudinal veins.

3rd Genus *Cecidomyia*.

DD. Two longitudinal veins.

4th Genus *Lasioptera*.

AA. Wings bending in the form of a roof, with numerous veins.

5th Genus *Psychoda*.

This author remarks that the genera *Lestremia* and *Zygoneura*, by the neuration of the wings, approached the Fongicoles (now the family Mycetophilidæ), amongst which he placed *Campylomyza*; and also that *Psychoda* was related to the Florales (now Rhyphidæ and Bibionidæ) by the shortened form of the body and the feet.

Rondani in 1840 made the first attempt at a division of *Cecidomyia* into sub-genera, and he also divided the whole family into two great sections, CECIDOMYINÆ and LESTREMINÆ, the latter to admit the genera *Campylomyza*, *Catocha*, *Lestremia*, and his own new genus *Micromyia*; but he founded his scheme on such uncertain criteria that subsequent authors have regarded it as entirely worthless, though it can scarcely be estimated of no value, for his project at least formed the basis of a more perfect classification. Since then Rondani has established a number of genera in this family, afterwards discovered to be synonymous with genera already accepted.

In 1850 Prof. (then Dr.) Loew wrote a valuable monograph of the European Cecidomyidæ, and, rejecting the attempt of Rondani, put another system in its place. He formed a number of sub-genera well adapted to satisfy that want to make these divisions into sub-genera, and not only that, but supplied further definitions to each of them, by means of which the contained species might again be divided and characterised, a necessary step to take on account of the great difficulty naturalists otherwise would have experienced in dealing with such a numerous family of small insects.

His main arrangement of the first section is as follows:—

Genus I. CECIDOMYIA, Meigen.

A. With three longitudinal veins. 1.

- | | | |
|-----|--|---------------------------------|
| 1 { | Collare more or less overhanging or hood-shaped. Wings without iridescence... | Sub-genus.
<i>Hormomyia.</i> |
| | Collare very slightly developed..... 2. | |
| 2 { | Transverse vein wanting or moderately oblique..... 3. | |
| | Transverse vein so oblique that the second longitudinal vein appears two-rooted 5. | |
| 3 { | Male with twice as many flagellar joints as the female..... | <i>Diplosis.</i> |
| | Both sexes with an equal number of antennal joints 4. | |
| 4 { | Antennæ hair-whorled..... | <i>Cecidomyia.</i> |
| | Antennæ with a short pubescence..... | <i>Asphondylia.</i> |
| | Flagellar joints sessile or almost sessile in both sexes..... | <i>Dirhiza.</i> |
| | Flagellar joints pedicelled in both sexes... | <i>Epidosis.</i> |

B. With four longitudinal veins..... *Asynapta.*

Genus II. LASIOPTERA, Meigen.

- | | |
|---------------------------------------|---------------------|
| Mouth prolonged in a rostrum..... | <i>Clinorhyncha</i> |
| Mouth not prolonged in a rostrum..... | <i>Lasioptera.</i> |

Winnertz in 1853 contributed another admirable monograph towards a knowledge of European gall-midges (Linnaea Entom. Vol. viii.), when he described a large number of fresh species, and added another genus *Spaniocera*, and a sub-genus of *Cecidomyia* which he designated *Colpodia*. After a lengthy and careful study of the material at his disposal, he expressed his conviction that all the sub-genera of Loew were founded on good characters, but that some of them required a more exact diagnosis, and that a still further division of them would greatly promote the determination of the species; and in order to fulfil this requirement he distributed the species of the first sub-family as below:—

I. CECIDOMYIA, Meigen.

I. WINGS WITH THREE LONGITUDINAL VEINS.

A. Transverse vein placed between the root and the tip of the first longitudinal vein.

Cecidomyia.—The second longitudinal vein ascending from the base in a flattened arcuation, and reaching the margin of the wing a little before its apex.

The number of the antennal joints usually equal in both sexes, the joints either pedicelled or sessile.

1. Antennal joints in the ♂ pedicelled, in the ♀ sessile.
2. In the ♂ and ♀ pedicelled (or the ♀ partly so).
3. In the ♂ and ♀ sessile.

Diplosis.—The second longitudinal vein ascending from the base in a flattened arcuation, and reaching the margin of the wing at or beyond its apex.

Antennæ in the ♂ 2-+24-jointed, sometimes with one rudimentary joint more, the pedicelled joints alternately single and double, very seldom all the joints simple, in several species the joints decorated with long hairs in the upper side.

Antennæ of the ♀ 2-+12-jointed, sometimes with one rudimentary joint more, the joints pedicelled, cylindrical.

(a) The second longitudinal vein reaching the margin of the wing at its apex.

1. Flagellar joints of the antennæ of the ♂ alternately single or double.

* Wings unspotted.

** Wings variegated.

2. Flagellar joints of the antennæ in the ♂ quite simple, with only one hair-whorl.

(b) The second longitudinal vein reaching the margin of the wing beyond its apex.

1. Hair-whorls of the antennæ of the ♂ equally long on the upper and under sides.

* Wings unspotted.

** Wings variegated.

2. Antennæ of the ♂ decorated with long hairs on the upper side.

Asphondylia.—The second longitudinal vein ascending from the base in a flattened arcuation, and reaching the margin of the wing beyond its apex.

Antennæ in both sexes with cylindrical joints, the joints without hair-whorls.

Hormomyia.—The second longitudinal vein ascending from the base in a flattened arcuation, reaching the wing-margin either at or beyond the apex.

Thorax more or less gibbose, frequently extending over the head in the form of a hood. Flagellar joints of the antennæ in the ♂ pedicelled, those of the ♀ either pedicelled or sessile.

(a). Thorax extending over the head in the form of a hood.

(b). Thorax gibbose.

Colpodia.—The second longitudinal vein ascending from the base with a double curvature, reaching the wing-margin beyond the apex. Transverse vein long.

B. Transverse vein very oblique, originating at the root of the first longitudinal vein.

Dirhiza.—The second longitudinal vein not undulating at the base, but ascending in a flattened arcuation, and the flagellar joints of the antennæ sessile or almost sessile in the ♀.

Epidosis.—The second longitudinal vein ascending from the base with a double curvature, reaching the wing-margin beyond the apex.

The number of the antennal joints unknown; the joints pedicelled in both sexes.

II. WINGS WITH FOUR LONGITUDINAL VEINS.

Asynapta.—(a). The transverse vein and the root of the second longitudinal vein as in *Epidosis*.

(b). The transverse vein and the second longitudinal vein as in *Diplosis*.

II. SPANIOCERA, Winnertz,

III. LASIOPTERA, Meigen.

(a). Wing with a white spot in the middle of the costal vein.

(b). Wing without spot,

Clinothyncha.—Mouth parts prolonged in a rostrum.

With regard to the second section of the family, Winnertz prefers to look upon its species as representing a distinct family having its proper position between the Cecidomyidæ and the Mycetophilidæ. He afterwards (in 1869) wrote a paper solely on this section, which we will consider in its turn.

Baron R. Osten-Sacken, in 1862, wrote a preliminary or introductory paper on the North American Cecidomyidæ which appeared in the first monograph on Diptera issued by the Smithsonian Institution, and mainly prepared by Prof. Loew. In the first part

of the volume Dr. Loew, in giving a general sketch of the systematic distribution of Diptera, remarks, with regard to the family Cecidomyidæ, that it is one rather difficult to define, and consequently also difficult to exactly characterize. He considers that the limits between the families Cecidomyidæ and Mycetophilidæ are not easily fixed, since *Zygoneura* shows a combination of the characters of both, the coxæ being far less elongated and the spurs of the tibiæ far shorter than in any other genus of Mycetophilidæ; moreover, the antennæ are moniliform with verticillate hairs, as is frequently the case in the Cecidomyidæ and never so among Mycetophilidæ. But, he goes on, the total *habitus* of the *Zygoneura* being more like that of the former than of the latter, and the tibial spurs being so very short that in some species they can only be discovered by the closest scrutiny, he thinks himself justified if he adds them to the Cecidomyidæ, though in many respects they agree with the genus *Sciara*, which in his opinion has its natural place amongst the Mycetophilidæ. The family is divided by Prof. Loew into two sections; the first section he styles CECIDOMYINA, and the second ANARETINA, which he thus characterizes. The CECIDOMYINA have on their wings four longitudinal veins, the last two of which often coalesce in the beginning of their course, or are more or less incomplete; they have no ocelli, and the first joint of their tarsi is much shortened; the genera belonging here are *Cecidomyia*, Meigen; *Diplosis*, Loew; *Asphondylia*, Loew; *Hormomyia*, Loew; *Colpodia*, Winn.; *Dirhiza*, Loew; *Epidosis*, Loew; *Asynapta*, Loew; *Lasioptera*, Meigen; and *Clinorhyncha*, Loew. In the genera of the second section, the ANARETINA, between the second and third of those veins of the wings which the first section possesses, another longitudinal vein is inserted, being simple only in *Campylomyza*, while it is furcate in all the other genera; the first tarsal joint is not shortened, and in all genera, with the single exception of *Cecidogona*, there are distinct ocelli; to this section belong *Campylomyza*, Meigen; *Cecidogona*, Loew; *Anarete*, Hal.; *Catocha*, Hal. (= *Macrostyla*, Winn.); *Lestremia*, Maq. (= *Diamesa*, Meig.); and *Zygoneura*, Meig. He omits the genera

Heteropeza, Winn. (Stett. E.Z. VII., 1846) and *Spaniocera*, Winn. (Linnaea Entom. VIII., 1853) having never had an opportunity of examining specimens; and he totally disregards those of Rondani for the reason that they were founded on too inexact observations. Meinert's genus *Miastor* [Naturh. Tidssk. (3) iii.] was not established until 1864, two years after the publication of Loew's monograph. Reverting to Baron Osten-Sacken's work it is found that the method of classification he employs is derived chiefly from those of Winnertz and Loew, as above tabulated; but in order to better compare the three it is desirable to append that of the Baron, more particularly as it is mainly from these three authors that the arrangement followed in the present paper is derived, there being no reason to deviate much from the system applied by, and the result of much labour on the part of, these proficient Dipterologists; it stands thus:—

Section I. CECIDOMYINA, Loew.

CECIDOMYIA, Meig.—Three or four longitudinal veins; in the first case the third vein is forked, thus representing the third and fourth veins, which are coalescent in the greater part of their extent; in some rare cases a branch of this fork or the whole fork becomes obsolete; in the second case all the four veins are simple. Surface of the wings hairy; margins with long cilia. Antennæ long, moniliform or cylindrical, generally verticillate, seldom without verticils, from 13- to 36-jointed.

SPANIOCERA, Winn.—Three longitudinal veins, which are all simple (not forked); the first close by the costa, the second at some distance from it, but reaching the margin of the wing before its tip. Hairs on the surface of the wing scaly. Antennæ filiform, 13-jointed, joints elongated, cylindrical, with a short pubescence and without verticils.

LASIOPTERA, Meig.—Three longitudinal veins, the first and second of which run very near the costa, and are so closely approximated as to be hardly discernible. Wings rather short and broad. Antennæ from 16- to 26-jointed; joints subglobular,

sessile, with short verticils. (The sub-genus *Clinorhyncha*, Loew, has been formed of the *Lasioptera* having the mouth prolonged in a rostrum.)

CECIDOMYIA, Meigen.

I. Wings with three longitudinal veins, the third either forming a fork, or becoming more or less obsolete towards the tip.

A. Cross-vein placed between the root and the tip of the first longitudinal vein (in this section the cross-vein is frequently almost obsolete).

Cecidomyia, Loew.—The second longitudinal vein reaches the margin of the wing a little before its tip (although in most cases the distance is very short). Generally the same number of joints in the antennæ of the ♂ and ♀; joints either pedicelled or sessile (sometimes pedicelled in the ♂ and sessile in the ♀; sometimes of the same structure, pedicelled or sessile, in both sexes).

Diplosis, Loew.—The second longitudinal vein reaches the margin of the wing at or beyond its tip. Antennæ of the ♂ 26- (2 + 24) jointed, sometimes with one rudimental joint more; joints pedicelled, simple joints alternating with double ones, seldom all joints simple. Antennæ of the ♀ 14- (2 + 12) jointed, sometimes with one rudimental joint more; joints pedicelled, cylindrical.

Asphondylia, Loew.—The second longitudinal vein reaches the margin of the wing a little beyond its tip. Antennæ of both sexes with the same number of joints; the latter cylindrical, sessile, with a short pubescence and without verticils.

Hormomyia, Loew.—The second longitudinal vein reaches the margin of the wing either at or beyond the tip. Thorax more or less gibbose, frequently extending over the head in the form of a hood. Joints of the ♂ antennæ pedicelled; those of the ♀ pedicelled or sessile.

Colpodia, Winn.—The second longitudinal vein forms a curve before the cross-vein and joins the margin a little beyond the tip of the wing. Cross-vein rather large, oblique.

B. Cross-vein very oblique, originating at the root of the first longitudinal vein.

Dirhiza, Loew.—Second longitudinal vein hardly undulating before the cross-vein; joints of the antennæ sessile or almost sessile in both sexes.

Epidosis, Loew.—Second longitudinal vein sinuose before the cross-vein; joints of the antennæ pedicelled in both sexes; their number variable.

II. Wings with four longitudinal veins.

Asynapta, Loew.—The cross-vein is sometimes like that in section A, and then the second longitudinal vein is not sinuated; sometimes as in section B, then the second longitudinal vein is sinuated, like in *Epidosis*; in this case also the collare is a little prolonged.

SPANIOCERA, Winnertz.

LASIOPTERA, Meigen.

Olinorhyncha, Loew. Mouth prolonged in a rostrum.

Section II. ANARETINA, Loew.

I. Ocelli extant; wings bare or almost bare; third longitudinal vein forked, the two following veins simple.

ZYGONEURA, Meig.—Antennæ 16-jointed; ♂ verticillate, joints pedicelled; ♀ pubescent, joints sessile; branches of the fork of the third longitudinal vein very arcuated at the base.

ANARETE, Hal.—Antennæ 9-jointed, short, slightly pubescent; joints subsessile, subglobose.

Wings pubescent.

Third longitudinal vein forked.

TRITOTYZGA, Loew.—The upper branch of the fork forms a double curve, almost in the shape of an S.

CATOCHA, Hal.—The upper branch of the fork forms a single smooth curve; ♂ antennæ 16-jointed, verticillate, joints pedicelled; ♀ antennæ 10-jointed, pilose, joints moniliform.

CAMPYLOMYZA, Meig.—Fourth longitudinal vein forked; antennæ 11-20-jointed; ♂ moniliform, pilose; joints pedicelled; ♀ submoniliform, joints sessile, pubescent.

II. Ocelli wanting; third longitudinal vein forked; first longitudinal vein very short; wings pubescent; antennæ ♂ moniliform, verticillate; ♀ submoniliform, pubescent.

LESTREMIA, Macq.—Antennæ 16-jointed.

CECIDOGONA, Loew. Antennæ 11-jointed.

Both authors regarded this classification of the section ANARETINA as very imperfect, and indeed these insects were only considered provisionally as a section of the Cecidomyidæ, so little was known about them.

Winnertz in 1867 (Beit. zu einer Mon. der Sciarinen) includes *Zygoneura* amongst the genera of his new group, most of which were previously embodied in Mycetophilidæ. The characters of *Zygoneura* almost agree with those of *Sciara*, and the venation of the wings shows a decided relationship.

Whether I am right or wrong in accepting the genus *Cecidogona* it is not easy for me to decide; for although Prof. Loew (Stett. E.Z. 1844, p. 324) declares it to be without ocelli, Dr. Schiner seems to regard it as synonymous with *Lestremia*, and so also evidently does Winnertz (V. z-b. G. 1870, p. 35); and as if to further obscure the truth, Baron O.-Sacken places both genera in one division, characterised "ocelli wanting," notwithstanding Prof. Loew in the introductory portion of the same volume states that in all the genera in his section ANARETINA, with the single exception of *Cecidogona*, there are distinct ocelli. If *Cecidogona* does not possess ocelli, and it is difficult to believe, if these did exist, that they could have escaped the observation of Prof. Loew, then that genus is certainly valid, and distinct from *Lestremia*, which is wanting in ocelli; therefore I cannot feel justified in

rejecting the genus. Even if *Anarete* is not a doubtful genus, it cannot be received into this family.

In 1870, Winnertz (Verh. z.-b. Ges. in Wien, XX.) published a paper on these troublesome species, and located them in a separate group which he calls by the old name LESTREMINÆ, and he admits the genera *Campylomyza*, *Micromyia*, *Catocha*, and *Lestremia*. They consist, in his opinion, of transitional forms between the Cecidomyidæ and the Mycetophilidæ, differing from the former by the existence of ocelli, in the not shortened tarsi (with only a few exceptions), and in the more elaborate vein-system of the wings. And, as in *Campylomyza* and *Micromyia*, the species approach the section CECIDOMYINA; so they form a natural transition to the Sciaridæ by the ocelli, which are extremely small in *Lestremia*. Now all this seems to point to a separation, but I cannot disconnect *Campylomyza* or therefore *Micromyia* (which latter I regard, with Dr. Schiner, as belonging to *Campylomyza*) from Cecidomyidæ; an examination of the antennæ, venation of the wings, and the habits of the insects themselves would alone preclude that. Time may reveal to us new forms which may bridge over the gap between the two sections, or have the reverse effect; but for the present, I for one, shall include LESTREMINA as a sub-family of Cecidomyidæ; not omitting from it Loew's *Tritozyga*, an undoubtedly well-marked genus approaching *Campylomyza*.

A large number of genera in both sections, by different authors have been disallowed for various reasons; but it is unnecessary to mention them all here. *Villigera* even turned out to be a Coccid and no Cecidomyid at all! However by some chance (probably not having seen the publications), I may here unfortunately omit good genera, but should that be so I am sure the number would be very small. I have never seen more than the name of Stephen's *Diomyza*, and so am compelled to exclude that genus from want of information.

I shall divide the Cecidomyidæ in the first place into two sub-families CECIDOMYINA and LESTREMINA, and the whole may be taken as follows:—

Sub-family I. CECIDOMYINA.

- Genus 1. *Heteropeza* (Wtz.)
2. *Miastor* (Mein.)
3. *Cecidomyia* (Meig.)

Section I.

Sub-section A.

- Sub-genus *Gonioclema* (s.-g.n.)
Cecidomyia (Loew)
Diplosis (Loew)
Asphondylia (Loew)
Hormomyia (Loew)
Necrophlebia (s.-g.n.)
Chastomera (s.-g.n.)
Colpodia (Winn.)

Sub-section B.

- Dirhiza* (Loew)
Epidosis (Loew)

Section II.

- Sub-genus *Asynapta* (Loew)
Genus 4. *Spaniocera* (Winn.)
5. *Lasioptera* (Meig.)
Sub-genus *Clinorhyncha* (Loew)

Sub-family II. LESTREMINA.

- Genus 1. *Campylomyza* (Meig.)
2. *Tritozyga* (Loew)
3. *Catocha* (Hal.)
4. *Lestremia* (Macq.)
5. *Cecidogona* (Loew)

Besides the above divisions the species will be distributed according to Winnertz and Loew; and in order to present the whole system, I shall in the following pages insert all the genera, sub-genera, with their lesser divisions, in their respective positions, even though I may have no examples to represent them.

CHARACTERS OF THE FAMILY.

THE TRANSFORMATIONS.

I. *Ovum.*

The egg is longer than broad, the ends rounded, orange-red, yellow, or whitish. The nidus for the egg may be any part of a plant according to the habits of the species; some appear to simply deposit the eggs on the surface, many to sink them into a puncture in the surface, and others singly or grouped together under the bark of large trees. The time when the eggs are laid is probably generally early morning or in the evening. A few days as a rule elapse before the young larvæ emerge, but this is to a great extent influenced by the weather; in some cases the hatching is accomplished in a few hours. Prof. Loew is of opinion that species having but one yearly generation remain a considerable length of time in the egg state.

II. *Larva.*

The young larva is of an elongate slender form, almost transparent; and the colour of the same species visibly changes with the increase of age, varying from orange or pinkish through different shades of red, or perhaps becoming light yellow or whitish. The body is composed of 14 segments, of which the head is regarded as the first. Between this and the thoracic segments is situated a joint which has been considered as either belonging to the head or to the thoracic region. Three segments are allotted to the thoracic, and the nine remaining to the abdominal division. Stigmata placed one pair on the first thoracic segment, and a pair on each of the abdominal segments except the last, appearing as more or less nipple-shaped prominences. The last two sometimes project considerably more than the preceding ones, and are occasionally removed towards the middle of the segment. Integument diaphanous, generally finely shagreened.

Head small, retractile, provided with a pair of two-jointed rudimentary antennæ, and a soft fleshy protuberance regarded by Ratzeburg as the labium. A slender coriaceous or corneous organ rooted in the first thoracic segment and projecting anteriorly, terminating just behind the head, is styled the breastbone. "This organ," remarks Baron Osten-Sacken, "the use of or the homology of which is unknown, is peculiar to the larvæ of *Cecidomyia*, and seems to be seldom wanting. It may be that this organ is used for locomotion, although I hardly would consider it as homologous with the pseudopods of the larvæ of *Chironomus* and *Ceratopogon*. If the supplementary segment (between the head and thoracic division) be considered as a part of the head, this breastbone might be taken for the mentum, in analogy to the horny mentum of the larvæ of the *Tipulariæ*. The form of this organ is variable in different species; sometimes it ends anteriorly in two points, with an excavation between them; sometimes in one elongated point; or it is serrated, etc." The terminal body segment is frequently provided with stiff or horny processes, which are employed, by some species at least, as saltatorial organs. The motions of the larvæ are in the majority of cases very slow indeed, though in some few species considerably accelerated by the provision of pointed projections, or in some cases even pseudopods, on the underside of the thoracic and abdominal segments.

In order to undergo its next metamorphosis the larva may leave the gall or malformation it inhabits, and bury itself in the ground; or it may inclose itself in a cocoon on the surface of a leaf, or hide beneath dry bark, in rotten wood, under leaves, &c., according to the species. *Lasioptera vastatrix* never once leaves the grass-stem in which it is deposited as an egg, until it assumes the imago state, and previous to turning into the chrysalis spins for itself a filmy silken cocoon. Winnertz remarks that although it is true that almost all the species belonging to the sub-genus *Cecidomyia* lie in the pupa state in a white cocoon, he could not convince himself that any cocoon was constructed of a veritable thread-work, not even in the case of *C. pini*, which Dr. Loew contended

was undoubtedly thread-work, but that the cocoon became deposited around the insect in crystalline form, without the larva betraying the slightest movement. The cocoon is ready after a few days, and even then under a high magnifying power no proper thread can be noticed. It is doubtful if the larvæ of the Cecidomyidæ undergo moultings. I believe that the length of time they remain in the larval form depends very much on the weather. They may be kept for months in that state in a dark box, but will emerge if restored to ordinary conditions. All are very liable to the attacks of parasitic Hymenoptera belonging to the family Proctotrupidæ.

About thirty years ago, Dr. Wagner, then Professor of Zoology in the University of Kasan, observed an asexual reproduction in the larvæ of a certain Cecidomyid. His observations were at first regarded as apparently "almost incredible," but were afterwards confirmed by the researches of Meinert, Pagenstecher, Loew, and other authors; and, according to their investigations, this "alteration of generation" (doubtless *frequently* occurring throughout the Cecidomyidæ), greatly resembles the mode of reproduction long before known to prevail in the Aphides.

Unfortunately, I have not yet been able to observe these germs in Cecidomyian larvæ, and must, for the present, refer those who desire to know more about this remarkable phenomenon, to the numerous papers which have been published from time to time, on this subject.

III. *Pupa.*

The pupa is smooth or minutely granulate (the dorsal abdominal segments often spined) and bears a considerable resemblance to the perfect insect, the eyes, head, thorax, antennæ, and feet being distinctly determinable, even to the joints of the two latter. The bases of the antennæ are frequently produced in points; these are long, hornlike, and close together, or short and wide apart. Two pairs of bristle-like processes appear in most pupæ, one on the head near the hornlike points, and the second pair on the thorax,

which some authors have made out to be the stigmata of the pupa. Winnertz suggests that certain tooth-like projections on the pupa may serve for breaking through the cocoon; in many cases after the escape of the imago the pupa skin is to be found hanging outside the gall. The number of the abdominal segments is nine, counting the anal joint, or that containing the genital organs. These insects ordinarily continue a very brief time in this state. The pupæ of the celebrated Hessian fly [*Cecidomyia* (*Diplosis*) *destructor*] are known as the "flax-seed" stage of that fly.

IV. *Habits and habitats of the perfect insects.*

In the perfect state I believe the majority of Cecidomyiæ live but a very short time, though individuals of some few species I know are obtainable for two or three months. In Australia these flies may be found throughout the year, but they abound mostly during the early spring—August and September. They do not vary very considerably in their modes of flight, and the majority seem to resort to some shady retreat during the heat of the day, such as the interiors of caves, the crevices in the rough bark of trees, &c.; towards evening they frequently fly into houses, and may be seen vivaciously fluttering up and down the window panes not directly exposed to the sunlight, apparently all the while just touching the glass with their fore-legs and butting with their head as they proceed, and by that means possibly accelerating their pace; after dark, like many other insects, they are attracted by artificial light. I have seen a few species leisurely hovering over the tops of low shrubs in the fullest heat of the day, evidently preferring sun-shine to shade. Some only travel a very limited distance; one species which I have noticed in very short grass quite open to the sun in the midst of the summer, appeared never to fly for more than a few seconds at a stretch, and then only to reach a spot not more than twelve inches from its previous position. The flight never appears to be along in a direct line, but is an irregular dancing movement, totally precluding any sort of conjecture as to the direction

in which the insect will eventually alight. A great number, if not the majority, of species have a peculiar proclivity for spiders' webs, and this is particularly noticeable in the numerous caverns, and under the overhanging rocks, on the Blue Mountains, and elsewhere, where the spiders have from crag to crag stretched their long threads of silk. In such secluded nooks and corners Cecidomyidæ may be seen sometimes in tens of thousands suspended closely side by side along the lines, evidently reposing, but commencing immediately, when approached, a peculiar oscillating movement which tends to render the insects themselves at the best only indistinctly visible on account of the rapid tremor, and very similar to the vibratory motion produced by an alarmed spider from the centre of its geometrical snare, or the long-legged Tipulidæ when at rest on a wall. In all these cases the motion seems to be equally a stratagem employed for protection,—in other words, a manoeuvre whereby to escape the observation of their enemies.

It is worthy of notice, too, that the Cecidomyidæ perfectly ignore both the purpose of the cobwebs and the nature of their dangerous proprietors; never once have I, or has Mr. Masters, observed any of their remains ensnared, nor do the spiders appear to trouble themselves one iota about these small flies, which suddenly take wing on the least apprehension of danger. Notwithstanding the insignificant size of the generality of the gall-gnats, if a considerable number of festoons be disturbed, the hitherto silent cave soon reverberates with the harmonious hum produced by the vibration of thousands of little wings.

I have but rarely seen a Cecidomyid walking, that is, quietly travelling without using the wings; or standing at rest on a solid or hard foundation, if there was the smallest film of cob-web on which to hang, within reach.

The Cecidomyidæ,* or gall-gnats, as their name implies, attack plants, thereby causing excrescences or distortions of the particular

* From *κηκis*, a gall; *μύια*, musca, a fly.

part in which the female inserts her ovipositor and deposits her eggs. Although many of these excrescences offer a striking analogy to those of the true Hymenopterous gall-flies (Cynipidæ), many of the deformations, as, for instance, some to be observed in leaves, are merely discolourations and rolls, while *Lasioptera vastatrix*, a native of this country, simply causes a slight swelling of a portion of the skin; still all the deformations are commonly regarded as galls, however erroneously, and are spoken of as such. Different species are said to attack different plants, or unfrequently an allied species of plant, and each gall-gnat infests only a particular part of the plant, whether it be root, stem, flower or fruit.

The list given by Julius E. von Bergenstamm and Paul Löw (Synopsis Cecidomyidarum, Verh. z-b. Ges. Wien, XXVI, 1876), shows from the variety there recorded, that almost every family of plants probably furnishes sustenance to the larvæ of gall-gnats. In the same highly invaluable paper 463 species of Cecidomyidæ are catalogued, being the total then described from all parts of the globe; probably that number has doubled since then. Out of the 463, however, some are not known beyond the larval state, and the deformation they produce; and altogether, accounts of the economy and larvæ of something over a fourth part only have been published. Although the larva of a Cecidomyid is unmistakable, I do not think that the distinctions between those of different species are sufficient to warrant the bestowal of new names, and I much doubt if differences sometimes existing between the galls or malformations are very often sufficient criteria, yet of course it is constantly possible to decide that certain remarkable galls are the work of particular insects. Notwithstanding that a considerable amount has been written about this family by eminent men during the last 50 years, there is a very great deal yet to be done, and especially outside the more civilized portions of the world.

A few remarks may be added upon the geographical distribution of Cecidomyidæ.

Species of the genus *Cecidomyia* have been described from almost all parts of the world—in Europe, from Lapland and

Russia to Italy; from Egypt and the Cape of Good Hope; from North and South America, Borneo, and Australia; and *Lasioptera* is known to have nearly an equally wide range; and I believe that when the family has been equally studied in all countries, most if not all the genera and subgenera will be found represented all over the world; and though many forms may yet be discovered peculiar to certain countries, it is not probable that they will very greatly differ from known examples. The small species belonging to *Heteropeza*, *Miastor*, and *Campylomyza*, scarcely visible when on the wing, have been discovered in the widely-separated continents of Europe and Australia, and the last of these also from America; so, doubtless, they exist in Africa and elsewhere. A few species are common to America and Europe, but these evidently have been conveyed through the medium of commerce from one country to the other, through the introduction of the food plant.* According to Prof. Hutton, Cecidomyidæ are represented in New Zealand, but, like many of the other smaller insects, have never yet been described from that country. Certain it is, that the family is scattered far and wide over the whole globe. Examples are to be found in quite different, indeed opposite climates, with widely distinct floras, and therefore supporting perfectly indigenous species of gall-gnats. The sub-genera *Cecidomyia* and *Epidosis* are not only known to occur in widely remote latitudes, but they have been also detected in amber, which, although a fossil resin, is not regarded geologically as a very ancient product. Cecidomyidæ probably existed much earlier—undoubted remains of numerous Diptera have been found in the well-known Stonefield slate and lias of the Mesozoic ages. The apparently extinct genus *Monodicerana* has been established for a species described by Prof. Loew in 1850 from amber, and found associated with *Cecidomyia* and *Epidosis*.

That the species of this family all originated from a common centre, from a common stock, and since become widespread, is I think indisputable, but our present knowledge is insufficient to

* Since this paper was written, the Hessian fly has also been reported as causing much damage in the Wellington district, New Zealand.

enable us to form any adequate opinion from whence they originated, or in which direction they travelled, though we may have some vague notion how they have become dispersed. It is obviously highly improbable that these small frail flies could have migrated across the wide tracts of water now separating certain countries, but became distributed at some period during which these watery barriers dividing or completely isolating land at the present day, did not exist. If we consider the changes this earth's surface has undergone, and remember that in the Triassic period for instance the island-continent of Australia was part of the Palæarctic or Asiatic mainland, and that at that time the land was not broken up into the islands of the Eastern Archipelago, thus affording an opportunity for migration, some little light may be thrown on this interesting subject, which, however, cannot be further pursued in the present paper.

V. *Imago.*

External structure.

The head is small, above broader than long, round when viewed from the front. Eyes generally lunate or reniform, more or less contiguous on the front. Ocelli wanting in the sub-family CECIDOMYINA, but extant in the LESTREMINA. Proboscis short, thick, fleshy, directed towards the pectus. Palpi prominent, four-jointed, the first joint short, the last usually longest. Antennæ long, moniliform or cylindrical, generally verticillate-pilose, seldom without verticils, 10- to 36-jointed, of which the two basal joints are more or less cupuliform; flagellar joints sometimes pedicelled in the ♂ and sessile in the ♀; sometimes of the same structure, pedicelled or sessile, in both sexes. The thorax roundish, in some species gibbose, sometimes extending over the head in the form of a hood; without a transverse suture. Halteres never completely bare, often considerably haired or scaled; the stalk long and slender; club large. Legs generally very long and slender. Coxæ short; femora not thickened; tibiæ without spurs; tarsi five-jointed; the metatarsal joint much shortened in the first

sub-family. The claws weakly developed, with apparently only one cushion. Wings incumbent; proportionately large and broad, rounded at the apex, cuneiformly narrowed at the base; as a rule hyaline though sometimes pellucid, with a pale bluish or brownish tint, generally beautifully iridescent; sometimes marmorated; more or less covered with irregularly arranged hairs; occasionally scaly; all the anterior margin scaly; deeply ciliated at the apex and on the posterior margin. The number of longitudinal veins amounts to at least two or at most five, never less than four in the second sub-family, or more than four in the first sub-family. In both sub-families the last two longitudinal veins often coalesce for the first half of their length, forming beyond a more or less distinct fork. The additional longitudinal vein of the LESTREMINA is inserted between the second and third veins of the first sub-family, and is furcate in all genera but *Campylomyza*. A longitudinal wing-fold generally has its position just in front of the third longitudinal vein, and often partially encloses the latter, or less frequently totally excludes it from view. No species has more than one transverse or cross-vein, which lies between the first and second longitudinal veins, but it is frequently most indistinct, or sometimes altogether wanting. Abdomen elongate, composed of nine segments; in the ♂ cylindrical, provided with large holding forceps; in the ♀ acuminate, with a protruding or non-protruding ovipositor, rarely without two small lamellæ; the whole body with a covering of fine delicate hairs, or less frequently scales or scaly hairs, the latter occurring more often on the under surface of the abdomen and legs.

The prevailing body-colours seem to be shades of yellow and red, darkening into brown proportionately as the integument becomes more horny. The expanse of the largest species exceeds four lines, that of the smallest less than a line. Regarding the relative number of the two sexes the females seem to be far more numerous than the males.

Sub-family I. CECIDOMYINA.

Wings with not more than four longitudinal veins, the two last frequently combining in the beginning of their course, forming a

more or less distinct fork ; no ocelli ; first tarsal joint much shortened.

Genus 1. HETEROPEZA, Winn.

Winnertz, Stett. E.Z. VII. 1846, p. 13 ; V. z.-b. G. Wien, 1870, p. 4, pl. i. ; Schiner, Fauna Austr. II. 1864, p. 410.

Antennæ in the ♂ moniliform, 2-+9-jointed, in the ♀ sessile, 2-+8-jointed ; basal joint incrassate. Joints of the palpi of unequal length. Legs short ; the third joint of the tarsi very long, the fourth and fifth short. Wings almost bare, with two longitudinal veins (Pl. II., fig. 1).

Very few species are known ; others have probably escaped notice on account of their small size. All but the following, I believe, have been recorded from Europe. Although I have carefully searched for *H. transmarina* in the neighbourhood of Sydney, my endeavour to find it, or indeed any other member of the genus, has been hitherto unattended with success.

1. HETEROPEZA TRANSMARINA, Schiner.

Heteropeza transmarina, Schiner, Dipt. der Novara-Expedition, Zool. Theil. Bd. ii. p. 5, Taf. 1, fig. 1, ♀.

♀. "Bright reddish-yellow ; the thorax blackish ; the eyes black ; the legs brownish-yellow, darker towards their extremity. Abdomen proportionally very long and slender. Ovipositor of the ♀ widely and very pointedly prominent, the first joint short, the second the longest of all. Antennæ brown, the first joint very large and thick, the others sessile, shortly oval. Legs delicate but distinctly hairy ; the femora rather robust ; the tibiæ long ; the tarsi exceedingly short, consisting of four rudimentary joints, the fifth apparently deficient ; the claws extremely small. Wings scarcely haired, not ciliated on the border ; the sub-costal (first longitudinal) vein nearly reaches to the apex of the wing ; the postical (second longitudinal) vein does not reach wing-margin.

Besides these two veins there is neither a wing-fold nor the rudiment of another vein."

¹/₆" Sydney (November and December).

Bred by Frauenfeld from small excrescences on the leaves of a species of *Callistemon*.

Genus 2. MIASTOR, Meinert.

Meinert, Nat. Tidskr. (3), III., 1864, p. 106; Schiner, V. z.-b. G. Wien, 1865, p. 87; H. Loew, Berl. E.Z. 1864, p. viii.; Winnertz, V. z.-b. G. Wien, 1870, p. 5, pl. i.

Eyes separated in both sexes by a broad forehead. Antennæ 2-+11-jointed; the basal joints cupuliform; the flagellar joints in the ♂ ovate with short pedicels and long verticillate hairs, in the ♀ moniliform, sub-sessile, with short verticils. Prothorax arched. Legs slender in the ♂, shorter and more robust in the ♀; the tarsal joints of unequal length. Wings almost bare, appearing granulate under a high power; three longitudinal veins; cross-vein sometimes present (Pl. II., fig. 2).

This generic name I think at present does not designate more than half-a-dozen species, and those described below are the only ones I know occurring out of Europe. Some, if not all, of the species undergo their transformation under the bark of decaying timber.

2. MIASTOR PROCAX, sp.n.

♀.—Length of antennæ.....	0·012 inch	... 0·29 millimètre
Expanse of wings	0·035 × 0·010	... 0·88 × 0·25
Size of body	0·040 × 0·005	... 1·01 × 0·12

Antennæ about as long as the thorax, joints globose, pale brown, decreasing in size towards the tip, the last two joints somewhat elliptical; basal joints yellowish, second one larger than the first. Hypostoma and palpi pale brown; front darker. Thorax chestnut brown, nitidous, with pale hairs; pleuræ yellowish tinged with brown. Halteres with a very large pyriform club, stalk yellowish-brown, club bright reddish-brown, with a dispersed pale

pubescence. Abdomen about three times as long as the thorax, pale yellow, ovipositor light umber brown. Legs brownish-yellow. First, third, and fifth joints of the tarsi of about equal length, and one and a half times the length of the fourth joint; second joint one and a half times the length of the first. Wings with a few decumbent hairs along the first and second longitudinal veins, also towards the end of the third longitudinal vein, and a few more dispersed close to the wing-margin at the tip. Veins very pale and indistinct. First longitudinal vein only just visible at either end; second longitudinal vein apparently starting under the middle of the first longitudinal, almost straight, disappearing a short distance from the apex, which it would meet if continued; third longitudinal vein running from the base of the wing close and almost parallel to the posterior border, joining about mid-way to the tip of the wing. Fringe long and fine, not dense. (Description drawn from fresh specimen).

Hab.—Elizabeth Bay, near Sydney (Skuse). Beginning of January.

3. *MIASTOR MASTERSI*, sp.n.

♂.—Length of antennæ.....	0.025 inch	...	0.62 millimètre.
Expanse of wings.....	0.035 × 0.010	...	0.88 × 0.25
Size of body.....	0.030 × 0.006	...	0.76 × 0.15

Antennæ pale yellow, nearly as long as the body, joints elongate, oval; twice the length of the pedicels; last joint sessile; long verticillate hairs. Hypostoma and front yellowish-brown. Thorax yellow, levigate, appearing minutely granulate under a high power; two sparse rows of hairs from the collare to the scutellum; pleuræ and scutellum yellow. Halteres yellow whitish at the base, moderately haired; club large, pyriform. Abdomen with the first two or three segments yellow, the remainder dusky yellowish; moderately haired; forceps with a very minute silvery pubescence. Legs dusky yellow. First and fourth tarsal joints short, of the same length; third and fifth about the same length, longer than the

last; second joint as long as the fourth and fifth together. Wings with a pale yellowish tint, more coarsely granulate than in *procaæ*; a few hairs at the base and along the second longitudinal vein; considerably fewer hairs on the wing than in *procaæ*; pale silvery reflection. First longitudinal vein very indistinct, extending about half-way to the tip of the wing; second longitudinal vein first visible close under the last at about two-thirds of its length, somewhat waving, disappearing some distance before the apex of the wing; third longitudinal vein close to the posterior margin, very indistinct before joining. (Description drawn from fresh specimen).

Hab. —Elizabeth Bay (Skuse). February.

Genus 3. CECIDOMYIA, Meig.

Meigen, Illig. Mag. II., 1803, p. 261; Macquart, S. à B. I., 1834, p. 159, pl. IV., figs. 10-11; H. Loew, D.B. IV., 1850; Winnertz, Linn. Entom., 1853, p. 186; O. Sacken, M. Dipt. N. Amer., 1862, p. 175; Schiner, F.A. II., 1864, p. 369.

Antennæ long, moniliform or cylindrical, generally verticillate, rarely without verticils, from 2-+9- to 2-+36-jointed. Wings with three or four longitudinal veins; generally a longitudinal fold between the second and third longitudinal vein (Pls. II. and III., figs. 3-16).

Section I.

Wings with three longitudinal veins, the third either forming a fork or becoming more or less obsolete towards the tip.

Sub-section A.

Cross-vein, if present, placed between the root and tip of the first longitudinal vein.

Sub-genus 1. GONIOCLEMA, sub-gen. nov.

Antennæ in the ♀ 2-+11-jointed, joints pedicelled, sub-cylindrical; verticillate-pilose. Second longitudinal vein reaching the margin at the apex of the wing; cross-vein distinct; third longitudinal vein not forked; first, third, fourth, and fifth joints of the tarsi short (Pl. II., fig. 3).

4. GONIOCLEMA PAUXILLULA, sp.n.

♀.—Length of antennæ.....	0·015 inch	... 0·38 millimètre.
Expanse of wings	0·036 × 0·015	... 0·90 × 0·30
Size of body.....	0·025 × 0·005	... 0·62 × 0·12

Antennæ about as long as the thorax, joints sub-cylindrical, almost sub-globose; terminal joints somewhat decreasing in size; separated by pedicels rather more than half the length of the joints; verticillate-pilose; yellowish; second basal joint much smaller than the first. Hypostoma and front pale brownish yellow; palpi yellowish. Eyes belting, contiguous on the front. Thorax sordid yellow, nitidous, with a few hairs along two pale, very indistinct lines, from the collare, meeting at a point at the scutellum; collare and pleuræ sordid yellow, somewhat paler than the thorax; scutellum large, almost semi-circular, sordid yellow. Halteres large, yellowish, with a few hairs. Abdomen about twice as long as the thorax, pale yellow, with a sparse pubescence; ovipositor short. Legs short, rather slender, pale yellow, with brownish hairs; the first, third, fourth and fifth joints of the tarsi short, second joint almost three times as long as the first. Wings pellucid, with a very pale bluish tint, rather thickly haired; very little reflection. First longitudinal vein very close to the costa, and scarcely distinguishable from it except for a short distance past the transverse vein; second longitudinal vein straight from the transverse vein, reaching the margin of the wing at the apex; third longitudinal not forked and not reaching the posterior margin. (Description drawn from dried specimen).

Hab.—Elizabeth Bay (Skuse). September.

Obs.—I have only seen a single specimen of this distinct form.

Sub-genus 2. CECIDOMYIA, Loew.

Antennæ 2- + 9- to 2- + 22-jointed; generally the same number of joints in those of the ♂ and ♀; joints pedicelled or sessile alike in both sexes, or pedicelled in the ♂ and sessile in the ♀. Second longitudinal vein reaching the margin of the wing before the apex (Pl. II., figs. 4 and 5).

a. *Flagellar joints of the antennæ pedicelled in the ♂, and sessile in the ♀.*

5. *CECIDOMYIA FRAUENFELDI*, Schiner.

Cecidomyia Frauenfeldi, Schiner, Diptera der Novara-Expedition, Zool. Theil. Bd. II. p. 7. Taf. 1, fig. 7, ♂.

♂ and ♀.—“Pale reddish-yellow; the thorax dark brown, almost imperceptibly hoary; the abdomen more or less clouded with black on the upper side, always lighter between the segments. These cloudings of the abdomen show always in a greater degree in the ♂ than in the ♀. The anal appendages of the ♀ split, clubbed. The ovipositor of the ♀ much projecting, sharp, pointed, the last joint dark brown. Antennæ brownish-yellow, 2-+18-jointed (these were the numbers counted in the ♀, the antennæ of all the ♂ examples had the tip broken off and the most perfect had only 17 joints), the joints in the ♂ globose and pedicelled, the pedicel as long as the joint, in the ♀ sessile, somewhat depressed in the middle; the joints with long verticils. Legs pale yellowish, the hindmost very long. Wings with pale-yellow pubescence and yellowish-brown veins; the sub-costal (first longitudinal) vein before the middle of the wing; the cubital (second longitudinal) vein joining the margin well before the apex of the wing, its basal part near the base of the wing very indistinct; the postical (third longitudinal) vein beyond the middle of the wing forked, the upper (anterior) branch set on the posterior branch, then curved forwards, the under (posterior) branch slightly waving, verging into the margin before the middle of the wing.”

$\frac{3}{4}$ —1". Sydney. November 6th to December 6th.

“Almost exactly like *C. circinas*, Giraud.”

According to Schiner's note appended to the description of this species, Frauenfeld bred specimens from rosette-like malformations covering the swollen branch buds of a species of *Melaleuca* found at “Naraby Lagoon,”* Port Jackson. The fly emerged from the pupa in about 14 days.

* Frauenfeld evidently means Narrabeen Lagoon.

6. *CECIDOMYIA VITULANS*, sp.n.

♂.—Length of antennæ ...	0·018 inch	...	0·44 millimètre.
Expanse of wings	0·035 × 0·015	...	0·88 × 0·38
Size of body.....	0·035 × 0·010	...	0·88 × 0·25

Antennæ dark-brown, 2-+9-jointed, joints twice as long as broad, almost cylindrical; pedicels very short; verticils somewhat dense, long. Hypostoma and front brown. Vertex covered with small yellowish scales; a few long erect hairs. Thorax dark brown, nitidous, with two rows of rather long yellow hairs from the humeri to the scutellum; collare dark brown; pleuræ sordid yellowish-brown; scutellum dark reddish-brown, with some yellowish hairs. Halteres yellowish at the base, the club with black or dark brown scales. Abdomen sordid yellowish-brown; dorsal segments with numerous small brown scales. Legs short and rather robust, yellowish-white, sericeous; the tarsi dusky. Wings pale reddish-brown at the base, densely clothed with a short pubescence, deeply ciliated along the posterior margin, and having a brassy reflection. First longitudinal vein close to the costa; cross-vein very indistinct; second longitudinal vein pale brown, very strong, curved anteriorly, reaching the wing-margin much before the tip; third longitudinal pale brown, with the anterior branch very indistinct, almost invisible. (Description drawn from fresh specimen).

Hab.—Elizabeth Bay (Skuse). Beginning of December.

7. *CECIDOMYIA DIFFICILIS*, sp.n.

♀.—Length of antennæ.....	0·018 inch	...	0·45 millimètre.
Expanse of wings.....	0·055 × 0·020	...	0·39 × 0·50
Size of body.....	0·045 × 0·014	...	1·13 × 0·36

Antennæ light umber brown, 2-+12-jointed, joints sessile sub-cylindrical, the last one twice the length of the preceding, and appearing as if composed of two joints, verticillate-pilose. Palpi brownish-yellow. Yellowish hairs on the vertex. Thorax

deep reddish-brown, levigate, with two longitudinal rows of yellowish hairs running about parallel to one another from the collare to the scutellum; collare and pleuræ red; scutellum reddish-brown with yellowish hairs; metathorax red. Halteres pale reddish-brown, the tip of the club and base of the stalk yellowish; the club elongate. Abdomen red with darker scales, and a row of semi-erect hairs on the hind border of each segment; rather paler between the segments; ovipositor long, light umber brown, the point reddish-yellow. Legs short and slender. Fore coxæ sordid yellow; hind and middle coxæ reddish. Fore and middle femora and tibiæ, also the hind tibiæ, sordid yellow; hind femora reddish-yellow. Tarsi cinereous. Articulations tinged with reddish. Wings hyaline, with fine pale pubescence, and a pale rosy reflection when viewed at a certain obliquity. The costal and two first longitudinal veins chestnut-brown; second longitudinal strong, almost straight, joining the costal considerably before the apex of the wing; transverse vein almost invisible, not very oblique; third longitudinal vein most indistinct, anterior branch nearly straight. (Description drawn from fresh specimen).

Hab.—Elizabeth Bay (Masters). Beginning of January.

8. CECIDOMYIA REGILLA, sp.n.

♀.—Length of antennæ.....	0·020 inch	...	0·50 millimètre.
Expanse of wings.....	0·040 × 0·017	...	1·01 × 0·42
Size of body	0·035 × 0·010	...	0·88 × 0·25

Antennæ pale-brown, 2- + 11-jointed, joints cylindrical, sessile, one half longer than broad, verticils somewhat sparse, moderately long, greatly appressed to the joints longitudinally; terminal joint very little smaller than any of the preceding ones, without any terminal process. Hypostoma and front yellowish-brown. Palpi moderately long, slender, yellowish-brown. Thorax dull black, with two rows of yellowish-brown hairs extending from the humeri to the scutellum. Poisers short, thick, the stalk pale at the base, with a dense covering of short black squamose pubescence to the base of the club; club large, apex scattered with

scales. Abdomen light red, with darker dorsal bands, with a few scattered black scales; terminal segment densely scaled; ovipositor short; lamellæ indistinguishable. Legs rather short. Coxæ femora and tibiæ broad, slightly pubescent, with a few scales; yellow tinged with red. Tarsi short, covered with black scales. Wings rounded, very densely covered with a scaly pubescence; pellucid, with a pale bluish tint; brassy reflection. Veins pale brown. First longitudinal vein rather close to the costa, and not very distinct on account of the thick pubescence; second longitudinal vein a little sinuose before the cross-vein, bent anteriorly, joining the costal at a point three-fourths of the distance from the apex of the wing; cross-vein short, indistinct; third longitudinal vein with its anterior branch very indistinct. (Description drawn from fresh specimen).

Hab.—Elizabeth Bay (Skuse). End of January.

9. CECIDOMYIA BACCATA, sp.n.

♂.—Length of antennæ.....	0.020 inch	...	0.50 millimètre.
Expanse of wings.....	0.035 × 0.015	...	0.88 × 0.38
Size of body.....	0.035 × 0.010	...	0.88 × 0.25

Antennæ dark-brown, 2-+9-jointed, joints sub-cylindrical, about twice as long as the pedicels; pedicels paler than the joints, verticils pale brown, moderately dense, long; terminal joint apparently with a very small nipple-shaped projection. Hypostoma and front brown; the first joint of the palpi small; the second joint saffron-coloured and much longer; third joint paler, longer than the second; fourth joint pale yellow, slender, about twice as long as the second. Thorax black, nitidous, two rows of hairs with a pale reflection, the hinder half with an oblong patch of clavate scales, niveous, with pale pearly reflections when viewed at a certain obliquity, reaching its margin posteriorly, but not extending to the lateral margins; pleuræ umber brown. Halteres with the apex black, elongate, not much thickened, stem pale brown. Abdomen umber brown, thickly covered with scales and hair. Legs short and robust. Coxæ pale reddish-brown. Front femora yellowish for

the greater part of their length; extremity blackish; middle and hinder pair blackish, yellowish at the base. Tibiæ yellowish-white, sericeous. Tarsi black with a somewhat hoary reflection. Wings pale reddish-brown at the base, densely covered with scales and scaly hairs, a vertical band of broader scales from the costal to the anterior branch of the third longitudinal vein; deeply ciliated along the posterior margin from the tip to the base; and having a violaceous reflection from the base to the outside margin of the squamous band, the tip brassy. First longitudinal vein rather close to the costa; cross-vein very indistinct; second longitudinal vein strong, curved anteriorly, joining the costal margin some distance from the tip; third longitudinal thick at the base, anterior branch very indistinct. (Description drawn from fresh specimen).

Hab.—Elizabeth Bay (Skuse). Beginning of December.

10. CECIDOMYIA NOBILIS, sp.n.

♂.—Length of antennæ.....	0·040 inch	...	1·01 millimètres.
Expanse of wings.	0·055 × 0·020	...	1·39 × 0·50
Size of body.....	0·050 × 0·010	...	1·27 × 0·25

Antennæ reddish-brown, 2- + 10-jointed, joints sub-cylindrical, nearly twice as long as broad, with long stiff verticillate hairs; pedicels pale, almost as long as the joints; terminal joint much larger and more slender than the preceding ones; basal joints paler, large. Hypostoma and front pale ferruginous. Palpi moderately long, pubescent, ferruginous. Thorax deep reddish-brown, with two rows of golden hairs from the humeri to the scutellum; humeri tipped with ochraceous-ferruginous; scutellum and pleuræ ferruginous-brown. Poisers short, yellow, the stalk and base of club with black scales; club pyriform. Abdomen ferruginous-ochraceous, with a pale pubescence; forceps sordid ochraceous, very densely haired. Legs moderately long, slender. Coxæ ferruginous. Femora ferruginous at the base, yellowish-white on the underside, and covered with deep brown scales and hairs on the upper side from the base to the tip. Tibiæ and

tarsi deep brown or black on account of their scales and hairs. Wings pellucid, with a very pale brownish tint, very densely haired and ciliated; bright bluish reflection. Venation pale and not very distinct. First longitudinal vein short, very close to the costa; second longitudinal vein very little bent posteriorly, reaching the margin immediately before apex of the wing; cross-vein not distinguishable; third longitudinal vein turning towards the posterior margin in an abrupt little rounded angle; anterior branch almost straight, most indistinct. (Description drawn from dried specimen).

Hab.—Gosford (Skuse). February.

Obs.—At first glance specimens of this insect bear a most striking resemblance to *Diplosis plumbea*.

11. CECIDOMYIA GIBBULA, sp.n.

♀.—Length of antennæ..... 0.035 inch ... 0.88 millimètre.

 Expand of wings..... 0.090 × 0.040 ... 2.27 × 1.01

 Size of body..... .. 0.070 × 0.020 ... 1.77 × 0.50

Antennæ blackish, 2- + 16-jointed, sessile, cylindrical, verticillate pilose. Hypostoma and front yellowish-brown; palpi grey, the fourth joint one-half longer than the third, second joint thicker than the rest. Thorax black, somewhat gibbose, levigate; scutellum sordid-yellow; pleuræ sordid-yellow, blackish at the base of the wings. Halteres yellowish, blackish at the base of the knob. Abdomen brownish-red, ovipositor long, yellowish. Coxæ yellowish-grey. Femora yellowish-grey, reddish at the tips. Tibiæ slightly reddish at the base, remainder of the joints and tarsi blackish, with a greyish reflection. Wings hyaline, with a yellowish pubescence, little reflection. Costal and two first longitudinal veins brownish; cross-vein very indistinct; first longitudinal vein so close to the costa as to be hardly discernible, a little divergent at the tip; third longitudinal indistinct. (Description drawn from dried specimen).

Hab.—Middle Harbour (Skuse).

b. *Flagellar joints of the antennæ stalked in the ♂ and ♀.*

c. *Flagellar joints of the antennæ sessile in the ♂ and ♀.*

Sub-genus 3, DIPLOSIS, Loew.

Diplosis, H. Loew, D.B. IV. 1850, p. 20 ; Rondani, II.^{da} Mem. Parma, 1840, &c. ; Winnertz, L.E., 1853, p. 187 ; O.-Sacken, Mon. Dipt. N. America, 1862, p. 176 ; Schiner, F.A., II. 1864, p. 382.

Second longitudinal vein reaching the margin of the wing either at or beyond the apex (Pl. II., figs. 6 and 7). Antennæ of the ♂ 2- + 24-jointed ; joints pedicelled ; simple joints alternating with double ones or all the joints quite simple, in the latter case the joints having only one hair-whorl ; joints sometimes with the hair-whorls equally long on the upper and under sides, often decorated with long stiff hairs on the upper side. Antennæ of the ♀ 2- + 12-jointed ; joints sub-sessile or having very short pedicels, cylindrical. Wings either unspotted or variegated.

A. SECOND LONGITUDINAL VEIN REACHING THE MARGIN OF THE WING AT OR BEFORE THE APEX.

1. Flagellar joints of the antennæ in the ♂ alternately single and double. (All ♀s with unspotted wings, the ♂s not being known are located provisionally in this group).

a. *Wings unspotted.*

12. DIPLOSIS LEPTOSPERMI, sp.n.

♂.—Length of antennæ.....	0.070 inch	...	1.77 millimètres.
Expanse of wings.....	0.070 × 0.035	...	1.77 × 0.88
Size of body.....	0.070 × 0.10	...	1.77 × 0.25

Antennæ pale brown, alternate joints one-half larger than the intermediate ones, sub-globose ; verticils short, dense ; pedicels shorter than the joints ; basal joints large. Hypostoma and front pale brown. Palpi short, slender, pale brown, with a minute yellowish pubescence. Thorax dull ochraceous-brown, yellow pubescence ; scutellum small, narrow, with a sparse yellowish pubescence ; pleuræ ochraceous, tinged with brown. Poisers ochraceous, densely pubescent ; stalk slender ; club large,

almost sub-globose. Abdomen ochraceous-brown, with a yellowish pubescence; forceps large, brown, pubescent. Legs short and slender. Coxæ and femora ochraceous, with yellow hairs. Tibiæ and tarsi ochraceous-brown. Wings very much rounded, pellucid, with a pale bluish tint, very densely haired, moderately ciliated, and having little or no reflection. Venation yellow. First longitudinal vein thick, slanting into the costa; second longitudinal vein nearly straight, pale at the base, reaching the wing-margin at the apex; cross-vein not distinguishable; third longitudinal vein arcuating wide of the margin before joining the posterior border; anterior branch very indistinct bending at first considerably upwards. (Description drawn from dried specimen).

Hab.—Sydney (Masters). Bred from malformed flowers of *Leptospermum* sp. in November.

13. DIPLOSIS PLUMBEA, sp.n.

♂.—Length of antennæ.....	0·060 inch	...	1·54 millimètres.
Expanse of wings.....	0·060 × 0·030	...	1·54 × 0·76
Size of body.....	0·060 × 0·020	...	1·54 × 0·50
♀.—Length of antennæ.....	0·040 inch	...	1·01 millimètres.
Expanse of wings	0·080 × 0·035	...	2·02 × 0·88
Size of body.....	0·080 × 0·025	...	2·02 × 0·62

♂ and ♀. Antennæ greyish-ochraceous, basal joints dull ochraceous; verticils dense, short; ♂ the double joints becoming more divided as they proceed, so that a short pedicel appears between the two portions of the terminal joint, thus forming two distinct joints; gradually diminishing in size towards the tip; pedicels of the single ones increasing in length; last joint with a slender projection; ♀ cylindrical, on very short pedicels, terminal joint with a bud-shaped process. Hypostoma and front ochraceous; palpi very slender, ochraceous. Thorax pale reddish-brown, with two longitudinal rows of long hairs from the collare to the scutellum, also some erect hairs in front of the origin of the wings; pleuræ and collare ferruginous-ochraceous. Halteres ochraceous, pubescent.

Abdomen ochraceous; the second, third, fourth and fifth dorsal segments in the ♂ with a small indistinct ferruginous spot; reddish-ochraceous, with a distinct black spot on the third dorsal segment in the ♀; densely haired. Legs moderately long, slender. Coxæ and femora pale ochraceous; upper side and tip of femora and the remaining joints cinereous. Wings more rounded in the ♂, ferruginous at their insertion, hyaline, densely pubescent, and densely ciliated round the whole margin; surface appearing as if blacklead when viewed at a certain obliquity. Veins pale. The second longitudinal vein slightly curved posteriorly, joining the costal at the apex of the wing in ♂; almost straight, bent somewhat anteriorly towards its end in ♀, reaching the margin about the same point as that of ♂; cross-vein very indistinct; third longitudinal rather indistinct. (Description drawn from fresh specimens).

Hab.—Elizabeth Bay (Skuse). January.

Obs.—I found this in large numbers on some small cob-webs about the bases of the fronds of four species of tree-ferns [*Alsophila australis* (N.S.W.), *Cunninghami* (Gippsland), *Cooperi* (Norfolk Island), and *Cyathea medullaris* (New Zealand)], planted in Mr. Macleay's garden. They probably occupied such situations for shelter only.

14. DIPLOSIS CONFINIS, sp.n.

♂—Length of antennæ ...	0.060 inch	...	1.54 millimètres.
Expanse of wings	0.060 × 0.030	...	1.54 × 0.76
Size of body	0.055 × 0.10	...	1.39 × 0.25

Antennæ ochraceous-brown, basal joints dull-ochraceous, verticils dense, pale; the double joints as in *D. plumbea* becoming more divided as they proceed, pedicels short. Hypostoma and front dull ochraceous. Thorax deep brown, almost black; humeri tinged with reddish; pleura and scutellum deep reddish-brown. Halteres ochraceous, reddish at the base, pubescent; club elongate, almost pyriform. Abdomen sordid ochraceous, without spots, densely pubescent; forceps hairy, ochraceous. Legs shorter than

in *D. plumbea*. Coxæ and femora red-ochraceous, the latter with a black line along the upper side. Remaining joints black, with a slight reddish tinge. Wings considerably rounded; almost hyaline; rather densely pubescent particularly towards the tip, moderately ciliated; displaying brilliant roseous, yellow, and chalybeous reflections when viewed in a certain light. First longitudinal vein short, close to the costa; cross-vein not apparent; second longitudinal vein nearly straight, joining the margin either at or immediately beyond the apex of the wing; third longitudinal vein indistinct. (Description drawn from fresh specimen).

Hab.—Sydney (Skuse). January.

Obs.—This species approaches *D. plumbea* very closely, but it is certainly distinct.

15. DIPLOSIS BREVIPENNIS, sp.n.

♂.—Length of antennæ..... 0.060 inch ... 1.54 millimètres.
 Expanse of wings..... 0.055 × 0.025 .. 1.39 × 0.62
 Size of body..... 0.060 × 0.015 ... 1.54 × 0.38

Antennæ brownish, with short greyish-yellow verticils, basal joints yellowish-brown; joints of the flagellum somewhat longer than the pedicels; alternate joints about double the size of the intermediate ones, last joint ending in a very minute nipple-shaped appendage. Head black, with some long greyish-yellow hairs on the vertex. Palpi pinkish. Thorax deep reddish-brown, appearing almost black anteriorly, levigate, with two patches of greyish-yellow recumbent hairs, diverging from the humeri; collare deep reddish-brown; pleuræ light reddish-brown. Halteres pale reddish-brown. Abdomen light reddish-brown, paler between the segments, with greyish-yellow hairs; forceps deep brown, densely haired. Legs very short. Coxæ light reddish-brown. Femora tinged with light reddish-brown at the base, the middle greyish-yellow, and the tip dark reddish-brown. Tibiæ sordid greyish-yellow, whitish at the base, and pale reddish-brown at the extreme tip. Tarsi sordid greyish-yellow, with pale articulations, appearing cinereous when viewed in a certain light. Wings pale

reddish-brown at the base, pellucid, of a pale brownish tint, with pale pubescence, moderately ciliated on the posterior border, with violaceous and brassy reflections. Veins pale brownish; transverse vein indistinct; second longitudinal vein reaching the margin at the tip of the wing. (Description drawn from dried specimen).

Hab.—Elizabeth Bay (Masters). December.

16. DIPLOSIS PERCITA, sp.n.

♀.—Length of antennæ	0·025 inch	...	0·62 millimètre.
Expanse of wings.....	0·070 × 0·030	...	1·77 × 0·76
Size of body	0·060 × 0·015	...	1·54 × 0·38

Antennæ greyish-brown, joints rather long, sub-sessile, cylindrical, with grey verticils; basal joints sub-globular, pale brownish, paler than the flagellar joints; last joint ending in a small cylindrical process about one quarter the length of the joint. Hypostoma, front, and palpi pale-brownish, about the same tint as the basal joints of the antennæ. Thorax greyish-brown, nitidous, with long erect yellow hairs; collare paler; pleuræ sordid-brown; scutellum pale reddish-brown, with long yellowish hairs. Halteres whitish at the base, the stem and club yellowish. Abdomen pale, greyish-brown, the dorsal segments banded with dark-brown, short yellow pubescence. Legs moderately long, slender, greyish, the tarsi with a dusky reflection. Wings pale reddish-brown at the base, pellucid, with a bluish tint, rather dense pubescence, well fringed, and having a bright brassy reflection. Veins pale brownish. Second longitudinal vein reaches the margin at the tip of the wing; cross-vein indistinct, not very oblique; third longitudinal very pale, straight until it branches, anterior branch curved slightly upwards at first, then running in a straight line. (Description drawn from fresh specimen).

Hab.—Elizabeth Bay (Skuse). December.

17. DIPLOSIS SCENICA, sp.n.

♂.—Length of antennæ	0·060 inch	...	1·54 millimètres
Expanse of wings.....	0·050 × 0·025	...	1·27 × 0·62
Size of body.....	0·035 × 0·008	...	0·88 × 0·20

Antennæ greyish-brown, joints short, about as long as the pedicels; verticils very dense, moderately long; second basal joint ovate, much larger than the first or the flagellar joints; no apparent process to the terminal joint. Hypostoma and front yellowish. Thorax greyish-brown, nitidous, with somewhat long pale hairs; pleuræ and scutellum pale reddish-brown. Halteres whitish at the base, the club elongate, obscure. Abdomen pale reddish-brown, with a fine yellowish pubescence, and a black patch on the first two or three dorsal segments. Legs moderately long, slender, yellowish-white, thickly haired, with a dusky reflection. Wings pale reddish-brown at the base, densely clothed with a somewhat long and bent pubescence; deeply fringed from the tip, along the posterior margin, to the base; and having a brassy reflection. Veins pale brown. First longitudinal vein close to the costal; cross-veins rather indistinct; the second longitudinal vein almost straight, curved exteriorly towards its end, joining the costal immediately before the apex of the wing; third longitudinal vein straight until it branches, anterior branch indistinct, starting just above the curvature of the posterior branch. (Description drawn from dried specimen).

Hab.—Elizabeth Bay (Masters). September.

18. DIPLOSIS LUCIDA, sp.n.

♂.—Length of antennæ.....	0.020 inch	...	0.50 millimètre.
Expanse of wings.....	0.050 × 0.020	...	1.27 × 0.50
Size of body.....	0.030 × 0.008	...	0.76 × 0.20

Antennæ greyish-brown, the basal joints pale brown, joints sub-sessile, cylindrical, verticillate-pilose. Hypostoma and front yellowish-brown; palpi paler. Thorax dark brown, nitidous, two rows of short hairs; pleuræ paler; collare yellowish-brown; scutellum pale brown, darker than the collare, covered with long erect hairs. Halteres brown at the base, stalk blackish, and the club whitish. Abdomen rather paler than the thorax, thickly covered with pale and somewhat long pubescence. Legs short. Coxæ brown. Femora pale brownish, with a black pubescence.

Tibiæ and tarsi cinereous. Wings pellucid, of a very pale yellowish tint, having a pale somewhat long and straight pubescence, and a cupreous reflection with a brilliant blue spot over the branch of the third longitudinal vein when held at a certain obliquity. Veins pale brownish. Costal with long erect hairs before the end of the first longitudinal vein; cross-vein pale, not very oblique; second longitudinal vein almost straight, joining the wing margin at the tip; third longitudinal pale and indistinct, particularly the anterior branch. (Description drawn from dried specimen).

Hab.—Woronora (Masters and Skuse).

19. DIPLOSIS PAULA, sp.n.

♀.—Length of antennæ..... 0·020 inch ... 0·50 millimètre.

Expanse of wings 0·050 × 0·015 ... 1·27 × 0·38

Size of body..... 0·040 × 0·006 ... 1·01 × 0·15

Antennæ brown, joints cylindrical, twice as long as broad, sessile, verticillate-pilose; terminal joint with a minute projection. Palpi pale brown. Hypostoma and front pale brown. Thorax nitidous, dark brown, two indistinct lines of paler brown with short pale hairs marking the divisions of the three usual stripes; humeri yellowish; pleuræ brown; scutellum prominent, ochraceous-brown. Poisers yellowish, white at the base; stem very slender, club large, pyriform, with a minute pubescence. Abdomen nitidous, ochraceous-brown, with a scattered yellowish pubescence; lamellæ elongate, yellowish. Legs moderately long, slender, yellowish grey, appearing darker on account of their pubescence. Wings pellucid, with a pale bluish tint; not very thickly haired; rosy and golden reflections. Veins yellowish-brown. Second longitudinal vein almost straight, reaching the margin before the apex of the wing; cross-vein distinct, not very oblique; third longitudinal vein indistinct, not turning abruptly towards the posterior border; anterior branch only bent at its base. (Description drawn from fresh specimen).

Hab.—Elizabeth Bay (Skuse). End of January.

20. DIPLOSIS ABBREVIATA, sp.n.

♀.—Length of antennæ.....	0.025 inch	...	0.62 millimètre.
Expanse of wings.....	0.040 × 0.015	...	1.01 × 0.38
Size of body.....	0.045 × 0.010	...	1.13 × 0.25

Antennæ grey, sub-cylindrical, joints somewhat darker than the pedicels, basal joints large, sub-globular, very pale, almost white, terminal joint apparently in an imperfectly developed condition, more slender than the preceding, verticils long, greyish. Head grey. Hypostoma and front yellowish; palpi pale, slender. Thorax yellowish-grey, nitidous, with two rows of long pale hairs from the collar to the scutellum; scutellum yellowish, haired; pleuræ pale yellowish-grey. Halteres bright yellow, stalk at base of knob darker. Abdomen reddish-yellow, covered with a fine pubescence; ovipositor short, very small oval yellow lamellæ. Legs short, uniform yellowish-grey, with a long pubescence on the femora and tibiæ, shorter on the tarsi. Wings pellucid, with a very pale bluish tint, thickly haired, and having a pale brassy reflection; fringe long. Veins yellowish; first longitudinal close to the costa; second longitudinal vein almost straight; cross-vein indistinct; third longitudinal most indistinct, the anterior branch being next to invisible. (Description drawn from fresh specimen).

Hab.—Sydney (Skuse). November.

21. DIPLOSIS ARDENS, sp.n.

♀.—Length of antennæ.....	0.025 inch	...	0.62 millimètre.
Expanse of wings.....	0.045 × 0.020	...	1.13 × 0.50
Size of body.....	0.040 × 0.010	...	1.01 × 0.25

Antennæ brown, more than half as long as the wings, joints sub-sessile, cylindrical, about twice as long as broad, with yellowish verticils; terminal joint somewhat conical. Hypostoma and front brown. Palpi reddish-yellow. Thorax dull castaneous, with the two longitudinal rows of hairs sparse, yellowish; scutellum reddish-brown, with a yellowish tinge on the posterior

margin, and a yellowish pubescence; pleuræ bright red-brown. Poisers very little thickened at the apex, the stalk yellow, with a slight pubescence, apex whitish. Abdomen bright red-brown, the dorsal segments with considerably darker bands, but the brighter colour appearing between them, very little pubescence except on the terminal joint; lamellæ small, oval, bright yellow. Legs moderately long, slender. Coxæ ferruginous-yellow. Femora and tibiæ yellowish. Tarsi cinereous. Wings considerably pointed at the base, rounded at the apex, pellucid, with a very pale yellow tint; sparingly haired, thicker towards the tip; moderately and rather densely ciliated; surface with golden reflections when viewed at a certain obliquity. Veins pale brown. First longitudinal vein rather close to the costa, but quite distinct; second longitudinal vein straight, reaching the margin considerably before the apex; cross-vein absent; third longitudinal vein running very near the posterior margin, bent exteriorly just before the tip; anterior branch indistinct, straight. (Description drawn from dried specimen).

Hab.—Sydney (Skuse). January.

Obs.—I have never observed the ♂ although the ♀ forms seem numerous.

22. DIPLOSIS CÆCA, sp.n.

♂.—Length of antennæ.....	0.045 inch	...	1.13 millimètres.
Expanse of wings.....	0.040 × 0.020	...	1.01 × 0.50
Size of body.....	0.020 × 0.006	...	0.50 × 0.15

Antennæ yellowish-grey, alternate joints one half larger than the intermediate ones, the basal portion paler, separated by pedicels about as long as the joints; verticils moderately long, bent; terminal joint with a pale slender pedicel-like projection. Front yellowish-brown. Palpi moderately long, yellowish-brown, with a sparse minute pubescence. Thorax light reddish-brown, nitidous, with a sparse long yellowish pubescence; scutellum yellowish-red; pleuræ ochraceous-brown. Halteres whitish, with a dusky pubescence, club elliptical, bare on the apex. Abdomen

dusky ochraceous-brown, with a dense yellowish pubescence; forceps small, densely surrounded by hair. Legs moderately long, very slender, almost cinereous; femora yellowish at the base. Wings rather pointed at the base, and considerably rounded at the apex, pellucid, with a pale bluish tint, densely and rather uniformly haired, though perhaps somewhat thicker towards the tip, densely ciliated, and having a pale brassy reflection. Veins yellowish. First longitudinal vein close to the costa; second longitudinal vein almost straight, reaching the margin of the wing immediately before the apex; cross vein absent; third longitudinal vein running rather close to the posterior margin, indistinct, without an anterior branch. (Description drawn from dried specimen).

Hab.—Elizabeth Bay (Skuse).

23. DIPLOSIS PROBATA sp.n.

♀.—Length of antennæ..... 0.020 inch ... 0.50 millimètre.

Expanse of wings..... 0.045×0.029 ... 1.13×0.50

Size of body 0.040×0.010 ... 1.13×0.50

Antennæ greyish-brown, half as long as the body; flagellar joints, sub-sessile, cylindrical, about twice as long as broad, with short verticils; basal joints yellowish-grey. Hypostoma and front yellowish-grey. Palpi moderately long, pale yellow, with a minute pubescence. Thorax light reddish-brown, nitidous, with a pale pubescence; scutellum almost lunate, pale yellow, with a sparse pubescence; pleuræ yellowish-grey. Halteres pale yellowish with a dusky pubescence, club pyriform. Abdomen yellowish-ferruginous, darker on the second and third dorsal segments; ovipositor short, lamellæ very small. Legs moderately long, very slender, uniformly cinereous. Wings very narrow at the base and greatly rounded at the apex, pellucid, with a very pale yellowish tint, somewhat sparingly haired, thicker towards the tip, and exhibiting a most brilliant golden reflection. Veins yellow. First longitudinal vein closely approximated to the costa; second longitudinal vein almost straight, bent

somewhat exteriorly at the tip, reaching the margin of the wing immediately before the apex; cross-vein rather indistinct, not very oblique; third longitudinal vein running very near the posterior margin, arcuated just before tip, indistinct; anterior branch absent. (Description drawn from dried specimen).

Hab.—Middle Harbour, near Sydney. (Masters and Skuse).
August.

Obs.—Closely allied to *D. cæca*.

24. DIPLOSIS VEGRANDIS, sp.n.

♂.—Length of antennæ.....	0·040 inch	...	1·01 millimètres.
Expanse of wings	0·035 × 0·017	...	0·88 × 0·42
Size of body	0·030 × 0·008	...	0·76 × 0·20
♀.—Length of antennæ.....	0·015 inch	...	0·38 millimètre.
Expanse of wings.....	0·040 × 0·015	...	1·01 × 0·38
Size of body	0·030 × 0·010	...	0·76 × 0·25

♂ and ♀. Antennæ brown, with greyish verticils; basal joints yellowish brown; ♂ alternate joints twice the size of the intermediate ones, the basal half of each joint pale like the pedicels; pedicels as long as the joints; ♀ cylindrical, sub-sessile. Front and mouth yellowish-brown. Palpi yellowish, short and slender. Thorax ochraceous-brown, nitidous, that of the ♀ with a reddish tinge; pale pubescence; humeri yellow; pleuræ somewhat reddish-yellow. Halteres yellowish with a greyish pubescence, club large. Abdomen reddish-yellow, with a conspicuous reddish-brown patch, generally on the first three or four dorsal segments, but sometimes extending further down the back, with a dense pale pubescence; ♂ forceps large, pale reddish-brown; ♀ ovipositor short, pale reddish-yellow. Legs moderately long, slender; about the same length in both sexes, if anything rather longer in ♂; greyish-yellow, with a cinereous pubescence, very dense on the tarsi making them appear considerably darker than the tibiae and femora. Wings hyaline, clothed with long hairs, deeply ciliated, with a brassy reflection; in ♂ somewhat rounder and shorter. Veins pale yellowish. Two first longitudinal veins very distinct,

the second one slightly bending exteriorly, reaching the margin of the wing before the tip; cross-vein most indistinct; third longitudinal vein most indistinct, running close to the posterior border; the anterior branch entirely wanting in most specimens. (Description drawn from dried specimens).

Hab.—Elizabeth Bay (Masters and Skuse). January.

b. *Wings variegated.*

25. DIPLOSIS BOMBYCINA, n.sp.

♀.—Length of antennæ.....	0·050 inch	...	1·27 millimètres.
Expanse of wings.....	0·085 × 0·045	...	2·14 × 1·13
Size of body.....	0·060 × 0·017	...	1·54 × 0·42

Antennæ nearly as long as the body; joints dusky brown, double, more than twice as long as broad, each half with moderately long verticillate hairs; joints twice as long as the pedicels, becoming gradually smaller towards the tip of the flagellum. Hypostoma and front pale ochraceous. Palpi slender, with a golden pubescence. Vertex ornamented with long golden hairs. Thorax deep brown, two very narrow pale longitudinal lines set with golden hairs, from the collar to the scutellum, mark the division of the usual broad stripes; humeri and scutellum ochraceous, the latter large, with erect hairs; pleuræ ochraceous-brown. Halteres whitish with a sparse pubescence, club elongate. Abdomen yellowish-red, sparingly clothed with yellowish hairs. Legs rather short and slender. Coxæ pale ochraceous. Femora pale ochraceous, with a dusky pubescence along the front, black at the tip. Tibiæ paler than the femora, dusky at the tip. First joint of the tarsi blackish; second joint pale; remaining joints blackish. Wings considerably rounded, pellucid, with a very pale bluish tint; very densely haired, the latter, in reflected light, appearing pale yellow, with bright violaceous markings. The latter first extending along the anterior side of the second longitudinal vein from the base to the tip, but not reaching the costa; another longitudinal patch between the second and third longitudinal veins, beginning directly in line with the tip of the first longitudinal vein, and extending to the

border of the wing below the apex ; a third patch is situated along the whole of the third longitudinal vein, enveloping its two branches but leaving a vacant triangular space of the yellow just under the arcuation of the posterior branch, and another between the fork ; this patch also appears to extend upwards to the base of the middle longitudinal band. (Description drawn from dried specimen).

Hab.—Sydney (Skuse).

Flagellar joints of the antennæ in the ♂ quite simple and with only one hair-whorl.

26. DIPLOSIS VILLOSA, sp.n.

♂.—Length of antennæ.....	0·060 inch	...	1·54 millimètres.
Expanse of wings.....	0·060 × 0·030	...	1·54 × 0·76
Size of body.....	0·050 × 0·010	...	1·27 × 0·25

Antennæ brownish-grey ; alternate joints just perceptibly larger than the intermediate ones ; terminal joint with a slender projecting process ; pedicels about as long as the joints ; verticils dense. Palpi pale yellowish. Thorax dull yellowish-brown, with two dense longitudinal rows of yellowish hairs running almost parallel from the collare to the scutellum ; pleuræ pale yellowish-brown. Halteres yellowish, pubescent ; club elongate, very little thicker than the stem. Abdomen light umbrous brown, thickly covered with yellowish pubescence. Legs rather short and slender. Coxæ yellow. Femora yellowish, with a light umbrous brown stripe along the upper side ; remaining joints light umbrous brown ; all with yellow articulations. Wings shorter than usual, and much rounded ; dark on account of their pubescence ; very densely clothed with greyish moderately long and somewhat interwoven hair ; pale bluish reflection. Veins of the same tint as the membrane of the wing. First longitudinal vein wide of the costal, running gradually into the margin about half way to the tip of the wing ; no apparent cross-vein ; second longitudinal vein prominent, very little bent posteriorly ; third longitudinal vein straight at first, then turning towards the posterior border

in an abrupt rounded angle ; anterior branch much arcuated from above the angle of the posterior branch. (Description drawn from dried specimen).

Hab.—Elizabeth Bay (Masters). January.

Obs.—I have only seen a single example of this well-marked species.

27. DIPLOSIS FACETA, sp.n.

♂.—Length of antennæ.....	0·050 inch	...	1·27 millimètres.
Expanse of wings.....	0·050 × 0·020	...	1·27 × 0·50
Size of body.....	0·030 × 0·006	...	0·76 × 0·15

Antennæ pale brownish-yellow ; joints all of the same size, subglobose ; terminal joint with a minute slender projection ; pedicels about one-half longer than the joints ; verticils somewhat sparse. Hypostoma and front pale yellowish-brown. Palpi very slender. Thorax sordid ochraceous-brown, nitidous, with a few rather long yellowish hairs ; pleuræ pale yellowish-brown ; scutellum large and prominent, yellowish-white. Halteres long, slender, with large pyriform club, yellowish-white, with a very fine pale pubescence. Abdomen sordid ochraceous-brown, with dusky or blackish markings on the first and second, and from the fourth to the eighth dorsal segments ; pale pubescence. Legs moderately long, very slender. Coxæ very pale. Femora pale, with a brownish-yellow pubescence at the tip. Tibiæ and tarsi densely covered with a brownish-yellow pubescence. Wings considerably flattened at the apex, very much narrowed towards the base ; hyaline ; sparsely haired, thicker at the apex ; moderately ciliated ; with a bright silvery reflection. Veins yellowish-brown. Second longitudinal little arcuated, reaching the margin at or immediately before the apex of the wing ; cross-vein short, not very oblique ; third longitudinal vein indistinct, turning abruptly towards the posterior border ; anterior branch not distinguishable on account of the wing fold. (Description drawn from dried specimen).

Hab.—Sydney (Skuse).

B. SECOND LONGITUDINAL VEIN REACHING THE MARGIN OF THE WING BEYOND THE APEX.

1. Hair-whorls of the flagellar joints in the ♂ equally long on the upper and under sides. (All ♀s with unspotted wings, the ♂s not being known, are located provisionally in this group).

a. *Wings unspotted.*

28. DIPLOSIS ADUSTA, sp.n

♂.—Length of antennæ.....	0·040 inch	...	1·01 millimètres.
Expanse of wings.....	0·100 × 0·045	..	2·54 × 1·13
Size of body.....	0·060 × 0·020	...	1·54 × 0·50

Antennæ dark brown almost black, sub-sessile, cylindrical; basal joints brown; terminal joint with a small projection; verticils pale brownish, rather dense. Hypostoma and front pale brownish; palpi yellowish-brown. Thorax smoky-brown, nitidous, two rows of hairs from the collare to the scutellum; scutellum yellowish-brown, with long erect hairs; pleuræ pale reddish-brown. Halteres blackish, pale at the base of the stalk and apex of the knob. Abdomen dark brown, paler underneath, with a bright yellowish pubescence; ovipositor short, pale brown. Coxæ pale yellowish-brown. Femora bright yellowish-brown, with a sparse covering of black scales and hairs, dense towards the tip. Tibiæ and tarsi black. Wings hyaline, with greyish pubescence, rather dense, especially towards the tip; splendid violaceous and purpureous reflections. The costal and two first longitudinal veins brown; cross-vein indistinct; third longitudinal pale. (Description drawn from dried specimen).

Hab.—Woronora (Masters and Skuse). October.

29. DIPLOSIS ARANEOSA, sp.n.

♂.—Length of antennæ.....	0·045 inch	...	1·13 millimètres.
Expanse of wings.....	0·100 × 0·040	...	2·54 × 1·01
Size of body.....	0·065 × 0·020	...	1·66 × 0·50

Antennæ greyish-brown ; joints cylindrical, twice the length of the pedicels ; verticils rather long and stiff ; basal joints pale ; end joint with a very small bud-shaped appendage. Labium and palpi pale yellowish-brown. Thorax dull greyish-brown, with two rows of erect greyish hairs arranged along two greyish stripes from the shoulders, but which do not coalesce posteriorly ; pleuræ greyish-yellow. Poisers pale and naked at the base, the stem and club brownish, thickly covered with deep brown scales or scaly hairs. Abdomen greyish-yellow, with the first two or three segments entirely of a dull, almost leaden grey ; long and dense brownish pubescence. Legs long and slender. Coxæ greyish-yellow ; the remaining joints greyish-brown with a light reflection. Wings pellucid, with a very pale bluish tint, densely clothed with yellowish somewhat bent hairs, posterior margin deeply ciliated at the angle, surface with rich golden and roseous reflections, the veins appearing violaceous. Veins greyish-brown ; costal well fringed ; transverse vein indistinct ; second longitudinal vein bent exteriorly, reaching the margin beyond the tip of the wing ; third longitudinal vein ill-defined, straight until it branches, turning towards the posterior border in an abrupt rounded angle. (Description drawn from dried specimen).

Hab —Elizabeth Bay (Skuse). October.

30. DIPLOSIS OBSOLETA, sp.n.

♀.—Length of antennæ.....	0·055 inch	...	1·39 millimètres.
Expanse of wings.....	0·100 × 0·040	...	2·54 × 1·01
Size of body.....	0·060 × 0·020	...	1·54 × 0·50

Antennæ dirty yellowish-brown ; joints cylindrical, twice as long as the pedicels ; verticillate hairs yellowish, dense, moderately long ; end joint with a very small nipple-shaped process. Palpi long and slender, yellowish-brown. Thorax deep brown, with two rows of yellowish hairs from the humeri, meeting at the scutellum ; humeri pale brownish ; pleuræ deep brown ; scutellum pale brownish. Halteres pale brownish with a fine pubescence.

Abdomen deep brown, with a pale pubescence. Legs long and rather robust. Coxæ brown. Femora, tibiæ and tarsi sordid brown with paler articulations, appearing of a uniform pale fulvous when viewed in a certain direction; the femora with somewhat long, pale, semi-erect hairs. Wings pellucid, with a bluish tint, very densely haired, the posterior border not very deeply ciliated, reflection obscure on account of the dense pubescence, with a somewhat pruinose appearance. Venation pale brownish. Costal densely fringed, hairs diminishing in length from the base to the end of the first longitudinal; transverse vein very indistinct; second longitudinal vein thinner towards the end, reaching the border considerably beyond the apex of the wing; third longitudinal pale, particularly the anterior branch. (Description drawn from dried specimen).

Hab.—Glenbrook (Masters). January.

31. DIPLOSIS MONTANA, sp.n.

♀.—Length of antennæ.....	0.040 inch	...	1.01 millimètres.
Expans of wings.....	0.100 × 0.040	...	2.54 × 1.01
Size of body	0.065 × 0.020	...	1.66 × 0.50

Antennæ deep brown; joints long, sub-sessile, sub-cylindrical; verticils pale brownish; basal joints brown, the first considerably larger than the second; terminal joint with a small bud-shaped appendage. Hypostoma pale brown. Palpi rather long, pale brown. Thorax deep brown, levigate, sometimes with a greenish appearance; humeri reddish-brown; pale pubescence; pleuræ deep brown almost black. Halteres pale at the base, the stalk brown, knob pale. Abdomen brown, dorsal segments darker than the undersurface, densely covered with a pale pubescence. Legs very long and slender. Coxæ brown. Femora yellowish-brown at the base, the anterior half greyish-brown, appearing blackish when viewed at a certain obliquity. Wings pellucid, with a pale brown tint, thickly haired, the posterior margin densely but not very deeply ciliated; brilliant purpureous reflection. Veins pale brownish. Costal densely ciliated, hairs long at the base,

diminishing in length to the end of the first longitudinal vein; cross-vein very oblique, distinct; second longitudinal vein much thinner towards the end, joining the wing-margin immediately below the apex; third longitudinal pale, anterior branch almost straight. (Description drawn from dried specimen).

Hab.—Glenbrook (Masters). January.

32. DIPLOSIS CONDIGNA, sp.n.

♂.—Length of antennæ.....	0·115 inch	...	2·91 millimètres.
Expanse of wings.....	0·100 × 0·035	...	2·54 × 0·88
Size of body.....	0·050 × 0·015	...	1·27 × 0·38

Antennæ greyish-brown; alternate joints twice as large as the intermediate ones, double joints as long as the pedicels; verticillate hairs moderately long and dense; basal joints pale brown, second one very small; terminal flagellar joint with a small bud-shaped appendage. Hypostoma and palpi yellowish-brown. Thorax smoky-brown, nitidous, with two rows of yellowish hairs from the collare, meeting at the scutellum; pectus and pleuræ pale brownish; scutellum paler than the metathorax. Poisers yellowish at the base, stalk and club with a greyish pubescence. Abdomen sordid brown, thickly clothed with long yellowish hairs. Legs long and slender, greyish-brown, densely pubescent. Wings narrow, pellucid, appearing of a pale bluish tint; densely covered with rather long bent hairs, somewhat tomentose towards the tip; a brassy reflection with a greenish tinge; a moderately long fringe on the posterior border. Veins yellowish-brown. Costal densely haired; transverse vein distinct; second longitudinal vein paler at the base, reaching the margin immediately beyond the apex of the wing; third longitudinal vein pale but perfectly distinguishable. (Description drawn from dried specimens).

Hab.—Elizabeth Bay (Masters and Skuse). Beginning of December.

33. DIPLOSIS FALLAX, sp.n.

♀.—Length of antennæ.....	0·040 inch	...	1·01 millimètres
Expanse of wings.....	0·090 × 0·040	...	2·27 × 1·01
Size of body.....	0·070 × 0·020	...	1·77 × 0·50

Antennæ greyish-brown; joints sub-sessile, cylindrical; pedicels paler; verticils long, sparse; basal joints large, pale yellowish-brown; terminal joint with a small nipple-shaped projection. Hypostoma and front pale yellowish-brown. Thorax smoky, yellowish, two rows of bright yellowish hairs; scutellum fulvous; pleuræ sordid yellow; collare yellowish-brown. Halteres blackish, pale at the base of the stalk. Abdomen pale brown, reddish posteriorly, with an obscure greyish patch on the first two or three dorsal segments; ovipositor short, yellow, with two small oval lamellæ. Legs cinereous with a lighter reflection, Wings pellucid, with a pale bluish tint, thickly haired, and having a brassy reflection. The costal and three longitudinal veins yellowish; cross-vein indistinct before joining the first longitudinal vein; third longitudinal very indistinct. (Description drawn from dried specimen).

Hab.—Woronora (Masters and Skuse).

34. DIPLOSION SULFUREA, sp.n.

♀.—Length of antennæ.....	0.033 inch	...	0.83 millimètre.
Expanse of wings.....	0.090 × 0.040	...	2.27 × 1.01
Size of body....	0.060 × 0.018	...	1.54 × 0.45

Antennæ faded brown; basal joints yellowish; joints of the flagellum stout, sessile, cylindrical, verticillate-pilose, the last joint with a very small cylindrical projection. Head yellow with some pale hairs. Hypostoma and front sordid grey; palpi slender. Thorax pale yellow, with two rows of somewhat long yellowish hairs. Halteres yellow at the base, upper portion with club reddish-brown, haired. Abdomen pale yellow, with a long pale yellowish pubescence. Legs rather long. Coxæ yellowish. Femora, tibiae, and tarsi yellowish, with a dense pubescence, and a pale reflection. Wings pellucid, of a pale yellowish tint, and having a very close pubescence; brassy reflection slightly tinged with violet; fringe dense, moderately long. Veins pale yellowish-brown. Costal vein strong; cross-vein fairly distinct, rather oblique; second longitudinal vein paler than the first, reaching the

wing-margin beyond the tip ; third longitudinal vein paler than the second, straight until it forks, posterior branch somewhat sinuous. (Description drawn from fresh specimen).

Hab.—Sydney (Masters and Skuse).

35. DIPLOSIS PARILIS, sp n.

♀.—Length of antennæ..... 0·035 inch ... 0·88 millimètre.

Expanse of wings 0·090 × 0·035 ... 2·27 × 0·88

Size of body 0·040 × 0·017 ... 1·01 × 0·42

Antennæ sordid yellowish-brown ; joints cylindrical, sub-sessile, about six times as long as the pedicels, verticillate-pilose ; basal joints pale brown ; no terminal process visible. Hypostoma pale brownish. Palpi long, slender, pale brownish. Thorax pale reddish-brown, levigate, with a pale pubescence ; humeri dull yellowish ; pleuræ sordid yellowish-grey ; scutellum pale brownish. Halteres sordid yellow at the base, stem and club greyish-yellow, with a blackish pubescence. Abdomen yellowish-grey, dorsal segments darker, densely covered with a yellowish pubescence. Legs long and slender. Coxæ yellowish-grey. Femora, tibiæ, and tarsi griseous. Femora pale, having a pale yellow appearance at the base. Wings pellucid, with a pale yellowish tint ; thickly haired ; golden and roseous reflections. Veins pale brown. Costal densely fringed, with some long semi-erect hairs before the junction with the first longitudinal ; cross-vein very oblique and indistinct ; second longitudinal vein somewhat indistinct at the base, thickened at the transverse vein and much thinner towards the end, reaching the margin immediately beyond the apex of the wing ; third longitudinal pale and indistinct, particularly the anterior branch ; posterior branch turning towards the border at a very abrupt and pointed angle. (Description drawn from dried specimen).

Hab.—Middle Harbour (Skuse).

36. DIPLOSIS BELLULA sp.n

♂.—Length of antennæ..... 0·080 inch ... 2·02 millimètres.

Expanse of wings..... 0·090 × 0·030 ... 2·27 × 0·76

Size of body..... 0·045 × 0·020 ... 1·13 × 0·50

Antennæ greyish-brown ; alternate joints very little larger than the intermediate ones, sub-globular, somewhat pyriform ; pedicels longer than the joints ; verticillate hairs greyish ; terminal joint with a long cylindrical process. Thorax with three very broad reddish-brown stripes almost coalescing anteriorly, the intermediate one reaching only to the middle, the lateral ones to the hinder margin ; the space between the three stripes very narrow, yellowish-brown, but there is a considerable surface of the yellowish-brown interval visible behind the limit of the middle stripe ; a few rather long pale hairs ; collare pale ; pleuræ and scutellum pale greyish-brown. Halteres with a blackish pubescence, the base of stem and tip of club naked. Abdomen light umber brown, somewhat darker superiorly, and densely clothed with a yellowish pubescence. Coxæ pale greyish-brown. Femora with a broad longitudinal stripe of dark pubescence above, a short yellowish pubescence and some very long stiff hairs underneath. The remaining joints cinereous, in some directions with a light reflection. Wings with a greyish pubescence, moderately long fringe on the costal and posterior margins, and a rich golden reflection, violaceous along the venation. Veins pale brown ; two first longitudinal veins well-defined, the second longitudinal vein reaching the wing-margin beyond the apex ; cross-vein indistinct ; third longitudinal also faint. (Description drawn from dried specimen).

Hab.—Peat's Ferry (Masters and Skuse).

37. DIPLOSI SENILIS, sp.n.

♀.—Length of antennæ.....	0.030 inch	...	0.76 millimètre.
Expand of wings.....	0.090 × 0.030	...	2.27 × 0.76
Size of body.....	0.045 × 0.015	...	1.13 × 0.38

Antennæ greyish-brown ; joints long, sub-sessile, cylindrical ; verticillate hairs long and rather light ; end joint with a small short process ; basal joints greyish-yellow, sub-globular. Hypostoma and front pale greyish-yellow. Thorax brown, levigate, with rather long yellowish hairs ; collare, pleuræ, and scutellum pale. Poisers pale, with a

sparse blackish pubescence. Abdomen pale, with a brownish tint, darker anteriorly, particularly superiorly on the first two or three segments, covered thickly with long pale shining hairs. Legs griseous, the coxæ and femora with a yellowish appearance. Wings pellucid, almost hyaline, with a very pale yellowish tint, well haired, more thickly towards the tip, purpureous and golden reflections, margined with a pale pubescence. Costal yellowish brown, some long pale hairs before the end of the first longitudinal vein; cross-vein pale and indistinct, very oblique; second longitudinal vein moderately curved, joining the wing-margin a short distance beyond the apex; third longitudinal pale and indistinct. (Description drawn from dried specimen).

Hab.—Coogee Bay, near Sydney (Skuse). In September.

38. DIPLOSIS RUSTICULA, sp.n.

♂.—Length of antennæ.....	0.070 inch	...	1.77 millimètres.
Expanse of wings.....	0.085 × 0.040	...	2.14 × 1.01
Size of body.....	0.045 × 0.015	...	1.13 × 0.38

Antennæ brownish; alternate flagellar joints a little longer than the intermediate ones; pedicels of the double joints as long as a simple joint; verticils greyish, moderately long; terminal flagellar joint with a small excrescence; basal joints sordid brown. Thorax faded brown, levigate, with some short pale hairs; pleuræ and scutellum sordid yellowish-grey. Halteres sordid yellow-grey at the base, the club whitish, with a black pubescence. Abdomen sordid brown, darker than the thorax, first segments almost black superiorly, covered with a somewhat long pale pubescence. Legs long. Coxæ yellowish-grey. Femora very pale yellowish, with a sparse blackish pubescence. Tibiæ and tarsi very pale yellowish, almost whitish, with a short pubescence. Wings pellucid, with a very pale brownish-yellow tint; closely haired on the surface, and having a pale roseous reflection. Veins yellowish-brown. Second longitudinal vein reaching the margin below the tip; third longitudinal indistinct, particularly the anterior branch. (Description drawn from dried specimen).

Hab.—Como (Skuse).

39. *DIPLOSIS FURVA*, sp.n.

♀.—Length of antennæ.....	0·030 inch	...	0·76 millimètre.
Expanse of wings.....	0·085 × 0·040	...	2·14 × 1·01
Size of body.....	0·050 × 0·017	...	1·27 × 0·42

Antennæ dark brown or black; joints thick, cylindrical; pedicels very short; basal joints brown; terminal joint with a narrow projection, more than half the length of the joint, verticillate-pilose. Hypostoma and front pale brownish; palpi long, slender. Thorax light brown, nitidous, with two rows of long erect hairs; pleuræ sordid brown; scutellum light brown, with long erect hairs. Poisers pale at the base, stalk and club thickly covered with brown scales and hair. Abdomen umber brown, with a dense long pubescence. Legs very long and slender, cinereous, almost black on account of their pubescence, the coxæ somewhat sordid brownish. Wings appearing almost blackish, densely clothed with moderately long slightly bent hairs, the posterior margin deeply ciliated, the fringe on the posterior angle much longer than the rest; bright brassy reflection. Costal covered with rather long hairs; cross-vein not very oblique, distinct; second longitudinal vein very little bent; third longitudinal vein pale, particularly the anterior branch. (Description drawn from dried specimen).

Hab.—Middle Harbour (Skuse).

40. *DIPLOSIS QUÆSITA*, sp.n.

♀.—Length of antennæ.....	0·025 inch	...	0·62 millimètre.
Expanse of wings.....	0·080 × 0·030	...	2·02 × 0·76
Size of body	0·045 × 0·015	...	1·13 × 0·38

Antennæ greyish-brown; joints sub-sessile, cylindrical, thick, verticillate-pilose; pedicels very short, scarcely visible, paler than the joints; terminal joint with a small nipple-shaped process. Labium and palpi yellowish-brown, the latter slender. Thorax reddish-brown, levigate, the usual two rows of hairs along narrow stripes of a paler brown, almost meeting posteriorly; collare and

scutellum yellowish-brown. Halteres blackish in the middle, yellowish at the base of the stalk, and club whitish. Abdomen reddish-brown, with a pale yellowish pilosity. Coxæ yellowish-brown. Femora very pale yellowish-brown with a black pubescence. Tibiæ and tarsi griseous. Wings pellucid, with a very pale bluish tint, a rather close pubescence, and a rich golden reflection. Veins greyish-yellow. Costal with long hairs before the tip of the first longitudinal vein, and thickly covered with a shorter pubescence throughout its length; cross-vein rather oblique, pale; second longitudinal reaching the margin of the wing a little beyond its tip; third longitudinal rather indistinct, anterior branch very little curved. (Description drawn from dried specimen).

Hab.—Woronora (Masters and Skuse).

41. DIPLOSIS CONSPECTA, n.sp.

♀.—Length of antennæ.....	0.050 inch	...	1.27 millimètres.
Expansion of wings.....	0.070 × 0.030	...	1.77 × 0.76
Size of body.....	0.070 × 0.010	...	1.77 × 0.25

Antennæ almost cinereous; joints large, cylindrical, separated by pedicels more than half the length of the joints; verticils greyish, moderately dense. Hypostoma and front pale reddish-brown; palpi pale yellowish-brown. Thorax deep brown, with two longitudinal rows of yellow semi-erect hairs meeting in a point at the scutellum; humeri reddish-yellow; scutellum and pleuræ light brown. Halteres slender, club pale brown, elongate, the stalk yellow. Abdomen red, terminal joints and ovipositor yellowish; pale yellowish pubescence. Legs rather short and robust, cinereous, the coxæ paler, and having pale articulations. Wings pellucid, with a pale bluish tint, somewhat ferruginous at their insertion, densely haired, particularly towards the tip, iridescent, with roseous and golden reflections; deeply ciliated on the anterior border for a short distance past the termination of the first longitudinal vein, at the tip, and on the posterior angle. Veins yellowish-grey. Transverse vein distinct, not very oblique; second

longitudinal vein joining the margin below the apex of the wing ; third longitudinal vein very indistinct. (Description drawn from dried specimen).

Hab.—Richmond, Hawkesbury district (Skuse). January.

42. DIPLOSION MOLLIPES sp.n.

♂.—Length of antennæ.....	0·065 inch	...	1·66 millimètres.
Expanse of wings.....	0·070 × 0·030	...	1·77 × 0·76
Size of body.....	0·040 × 0·010	..	1·01 × 0·25
♀.—Length of antennæ.....	0·035 inch	..	0·88 millimètre.
Expanse of wings.....	0·070 × 0·030	...	1·77 × 0·76
Size of body.....	0·050 × 0·015	...	1·27 × 0·38

Antennæ greyish; joints darker than the pedicels; ♂ alternate joints double; verticils greyish, moderately long; terminal joint with a small projection: ♀ joints cylindrical, twice as long as the pedicels, last joint ending in a small bud-shaped appendage; basal joints pale, almost white. Hypostoma and front pale yellow; palpi yellow. Thorax pale yellow, tinged with a light reddish-brown in the ♀, with two rows of long yellowish hairs; pleuræ, collare, scutellum, and halteres pale yellow, with a pale yellow pubescence. Abdomen paler yellow than the thorax, particularly of the ♀, densely covered with fine pubescence of the same colour. Legs very pale yellow, the fore and middle femora with a short, somewhat sparse, blackish pubescence on the upper side. Wings pellucid, with a very pale but somewhat impure bluish tint, rather close pubescence, and having a pale brassy reflection. Veins yellowish. Cross-vein pale, not very oblique; second longitudinal vein joining the margin beyond the tip of the wing; third longitudinal nearly straight from the base to the end of the anterior branch, posterior branch only slightly bent. (Description drawn from dried specimens).

Hab.—Sydney (Masters and Skuse).

Obs.—A large ♀ taken by Mr. Masters on 19th December, at Elizabeth Bay, has the last two joints of the tarsi blackish.

43. DIPLOSIS GILVA, sp.n.

♂.—Length of antennæ.....	0·070 inch	...	1·77 millimètres.
Expanse of wings.....	0·060 × 0·020	...	1·54 × 0·50.
Size of body.....	0·050 × 0·010	...	1·27 × 0·25

Antennæ longer than the wings, whitish; alternate joints twice the size of the intermediate ones; terminal joint with a small process; verticils short, dense; pedicels rather longer than the double joints; basal joints pale yellow. Hypostoma and front pale yellow. Palpi short, slender, pale yellow, Thorax pale brownish-yellow, with a yellowish pubescence: pleuræ pale brownish-yellow; scutellum large, prominent, pale brownish-yellow. Halteres pale yellow, pubescent; stem very slender, club elliptical. Abdomen very pale yellow, with pale yellow hair, forceps tinged with brown. Legs short, slender, pale yellow, pubescent, with a silvery reflection. Wings pellucid, with a pale yellowish tint, densely covered with a pale yellow pubescence, particularly towards the tip; pale silvery reflection. Veins yellow. Second longitudinal vein arcuating considerably exteriorly, reaching the margin a short distance beyond the apex of the wing; cross-vein very indistinct; third longitudinal vein very indistinct, turning abruptly towards the posterior margin, anterior branch invisible. (Description drawn from dried specimen).

Hab —Gosford (Skuse).

Obs.—Very like *D. mollipes*, but differing from it in the shortness of the legs, antennæ, &c.

44. DIPLOSIS DISCEDENS, sp.n.

♀.—Length of antennæ.....	0·015 inch	...	0·38 millimètre.
Expanse of wings.....	0·090 × 0·040	...	2·27 × 1·01
Size of body.....	0·055 × 0·010	...	1·39 × 0·25

Antennæ very short, ochraceous-brown; joints sessile, cylindrical, about twice as long as broad, with short, fine, yellowish verticils. Eyes considerably separated. Hypostoma and front

pale ochraceous. Palpi short, slender, ochraceous-brown, Thorax pale yellow, nitidous, with a golden pubescence; scutellum paler yellow, considerably rounded anteriorly, slightly pubescent; pleuræ pale ochraceous. Halteres large, the stem very slender, ochraceous-brown, pale at the base; club elongate, pyriform, ochraceous-brown. Abdomen pale yellow, with an ill-defined, roundish, dusky spot on the second or third dorsal segment, densely clothed with a short yellowish pubescence. Legs long, slender, densely haired. Coxæ ochraceous-brown. Femora ochraceous, ochraceous-brown on the front and at the tip. Tibiæ and tarsi ochraceous-brown, with a somewhat golden reflection when viewed at a certain obliquity. Wings hyaline, very densely and uniformly haired, moderately ciliated, with roseous and golden reflections. Veins pale brown. First longitudinal vein pale, joining the costal at about a third of the distance from the apex of the wing; second longitudinal vein pale and slightly sinuose before the cross-vein, running very near the first longitudinal at the cross-vein, then arcuating exteriorly, meeting the margin just beyond the apex of the wing; third longitudinal fairly distinct, turning abruptly towards the posterior margin; anterior branch at first bending upwards for a very short distance, then running almost direct to the border. (Description drawn from dried specimen).

Hab.—Elizabeth Bay (Masters).

45. DIPLOSIS ERRONEA, sp.n.

♀.—Length of antennæ.....	0.025 inch	...	0.62 millimètre.
Expanse of wings.....	0.06 × 0.020	...	1.54 × 0.50
Size of body.....	0.040 × 0.015	...	1.01 × 0.38

Antennæ greyish-brown; joints sub-sessile, cylindrical, verticillate-pilose; basal joints yellowish; terminal joint with a small projection. Hypostoma and front yellowish; palpi slender. Thorax yellowish-brown, somewhat shining, with a few rather long erect hairs; scutellum yellowish-brown; pleuræ pale yellowish-brown. Abdomen yellowish-brown, paler between the segments, with a

pale pubescence. Halteres yellowish at the base and tip of knob, middle portion covered with black scales. Legs cinereous, femora paler. Wings pellucid, with a pale bluish tint, yellowish pubescence, and a brilliant brassy reflection. Costal and first and second longitudinal veins pale brownish; first longitudinal vein very close to the costa; cross-vein long, indistinct; third longitudinal vein very indistinct. (Description drawn from fresh specimen).

Hab.—Sydney (Skuse). End of November.

46. DIPLOSIS HUMILIS, sp.n.

♂.—Length of antennæ..... 0.050 inch ... 1.27 millimètres
 Expanse of wings..... 0.050×0.020 ... 1.27×0.50
 Size of body..... 0.035×0.008 ... 0.88×0.20

♀.—Length of antennæ..... 0.044 inch ... 1.10 millimètres.
 Expanse of wings..... 0.065×0.025 ... 1.66×0.62
 Size of body..... 0.040×0.017 ... 1.01×0.42

♂.—Antennæ greyish-brown; alternate joints almost double the size of the intermediate ones; pedicels rather short; basal joints yellow; terminal joint with a slender projection. Front and mouth yellowish. Thorax pale brownish-yellow, nitidous, with a pale pubescence; pectus brownish; collare yellowish. Halteres yellowish, the stem long and slender, and the club almost globose. Abdomen pale yellow, with pale hairs, more dense and with a silvery reflection laterally, a dark patch on the first two or three dorsal segments, forceps yellow. Legs short and slender, pale yellow, femora slightly blackish on the upper side towards the tip. Wings pellucid, with a very pale purplish-brown tint, densely covered with a somewhat bent pubescence, and having a silvery reflection. Veins pale yellow. Transverse vein rather long, moderately oblique, indistinct; second longitudinal vein considerably bent posteriorly, reaching the margin below the apex of the wing; third longitudinal vein straight, turning towards the posterior border in an obtuse, scarcely rounded, angle.

♀.—Joints of antennæ deep brown, thick, cylindrical, on pedicels which are more than half the length of the joints; basal joints brownish-yellow. Hypostoma and front reddish-yellow; palpi reddish-yellow. Thorax pale reddish-yellow, with a pale pubescence; pectus reddish-yellow; collare yellowish. Halteres as in ♂. Abdomen reddish-yellow, densely clothed with short shining hairs, the first two or three dorsal segments with a blackish patch; ovipositor short, yellow. Legs rather longer and more robust than in ♂, the femora not so distinctly blackish as in ♂. Wings larger than those of the ♂, similar in other respects, except that the reflection is pale brassy. (Description drawn from dried specimens).

Hab.—Wheeny Creek, Hawkesbury district (Skuse). January.

Obs.—I found this in great profusion flying about the short grass exposed to the hottest sunshine, a striking contrast to the shade-loving propensities of most of the members of the family.

47. DIPLOSI SCELESTA, sp.n.

♂.—Length of antennæ 0.040 inch ... 1.01 millimètres.

Expanse of wings..... 0.040 × 0.020 ... 1.01 × 0.50

Size of body..... 0.030 × 0.008 ... 0.76 × 0.20

Antennæ ochraceous-brown; alternate joints of the flagellum only a little larger than the intermediate ones, globose towards the termination, the joints and pedicels only half the size of those at the base; basal joints almost twice the size of the neighbouring flagellar joints; pedicels shorter than the joints. Hypostoma and front pale ochraceous. Palpi slender. Thorax yellowish-brown, nitidous, with some pale hairs; pleuræ red-ochraceous, scutellum prominent, yellowish. Halteres ochraceous, sparsely haired, club large, ovate, almost globose. Abdomen red-ochraceous, densely clothed with a fine pale pubescence; forceps large, pale brown. Legs moderately long, slender. Coxæ pale reddish-ochraceous; remaining joints greyish-yellow, densely pubescent. Wings hyaline, rather short, somewhat rounded, thickly haired and having a deeply ciliated margin; pale argenteous reflection

when viewed at a certain obliquity. Veins slightly yellowish. Costal and two first longitudinal veins thick; second longitudinal vein gently arcuated exteriorly, meeting the costal immediately beyond the apex of the wing; third longitudinal particularly pale and indistinct, anterior branch altogether wanting. (Description drawn from dried specimen).

Hab.—Elizabeth Bay (Skuse). January.

b. *Wings variegated.*

48. DIPLOPSIS MACLEAYI, sp.n.

♀.—Length of antennæ.....	0·060 inch	...	1·54 millimètres.
Expanse of wings.....	0·090 × 0·050	...	2·27 × 1·27
Size of body.....	0·070 × 0·020	...	1·77 × 0·50

Antennæ nearly as long as the body; joints sordid grey, on yellowish-white pedicels half the length of the joints; verticils yellowish-white. Head dingy brown, with long yellowish hairs on the vertex; front pale. Palpi sordid grey. Thorax with three brown longitudinal stripes, the intermediate one pale, cuneiform; the lateral ones not so long, indistinctly elliptical; long-yellowish hairs; pleuræ pale brown. Halteres clothed with black hairs, the root of the stalk and tip of the knob naked, whitish. Abdomen deep reddish-brown, without bands, with yellowish hairs. Legs rather long, slender. Coxæ yellowish-brown. Femora sordid grey, the tips yellow. Anterior tibiæ golden-yellow, middle and hind ones black, the base with a slight ring of yellow. All the tarsi black on the first, short joint; the second joint golden-yellow with a broad ring of black near the base and at the tip; third and fourth joints hoary when viewed in a certain light, tipped with a ring of black. Wings pale yellowish, appearing of splendid colours when viewed in an oblique direction, with mottlings of a violet reflection. These violet markings prevail to such an extent as to leave only very little of the pale yellowish visible. A band commencing on the margin at about two-thirds of the distance from the base to the tip of the wing, running almost vertically downwards to the

first longitudinal vein, incurved from that to the second longitudinal vein, and descending again almost vertically to the margin about mid-way between the branches of the third longitudinal vein; a spot at the base of the wing enclosed by the transverse and the first and second longitudinal veins; a second small longitudinal spot over the junction of the first longitudinal with the costal border; a fourth appearance having the form of a narrow, irregular arcuation starting from the base behind the posterior branch of the third longitudinal vein, extending over the base of the anterior branch, and joining the margin again a short distance in front of the posterior branch; and lastly another spot occurs at the tip of the wing over the junction of the second longitudinal vein with the margin, indeterminate, somewhat extended posteriorly. Fringe of the wings pale yellowish, but blackish where the violet markings reach the wing-margin. (Description drawn from dried specimen).

Hab.—Woronora (Masters and Skuse). October; in caves.

49. DIPLOSI DIBAPHA, sp.n.

♀.—Length of antennæ.....	0·040 inch	...	1·01 millimètres.
Expanse of wings.....	0·070 × 0·030	...	1·77 × 0·76
Size of body.....	0·050 × 0·010	...	1·27 × 0·25

Antennæ cinereous; basal joints large, yellowish; joints of the flagellum sub-cylindrical, more than twice as long as broad, verticillate-pilose, four times as long as the pedicels; terminal joints with a slender projection. Vertex with long golden hairs. Palpi slender, yellowish. Thorax dull castaneous, two longitudinal rows of golden hairs from the humeri to the scutellum, dense, spreading over the middle cuneiform portion; also some golden hairs in front of the base of the wings; pleuræ pale brown; scutellum dull castaneous, with golden hairs. Poisers large, with a minute golden pubescence, slightly blackish just beneath the club, the latter pyriform. Abdomen uniformly dull castaneous, terminal joints with a yellowish tinge, densely clothed with yellowish or golden hairs; ovipositor as long as the abdomen,

yellow. Legs moderately long and slender, covered with a rich golden pubescence, the upper side of the femora, and the tarsal joints more or less tinged with blackish. Wings pellucid, with a very pale bluish tint, densely pubescent, in an oblique direction appearing almost golden-yellow with bright violaceous spots. One longitudinal spot on the costal border, extending over the anterior half of the first longitudinal vein, another below the second longitudinal vein rather in advance of the first spot. The whole apical portion of the wing enveloped in a more or less nebulous marking, a small spot of the yellow being distinctly visible at the tip of the second longitudinal; this colour runs also in a narrow band up the anterior branch of the third longitudinal vein, and widens as it extends down the posterior branch to the margin of the wing, forming an irregular arcuation; in the middle of the anterior branch a short band extends upwards, not so far as, and immediately anterior to, the second named spot. Another ill-defined marking exists on the margin just before the base of the third longitudinal vein. Veins yellow. Second longitudinal vein thick, reaching the margin immediately beyond the apex of the wing; third longitudinal not very distinct. (Description drawn from dried specimen).

Hab.—Illawarra district (Masters and Skuse); Coogee Bay (Skuse). September.

50. DIPLOSIS FREQUENS, sp.n.

♂.—Length of antennæ....	0.050 inch	...	1.27 millimètres.
Expanse of wings	0.055 × 0.025	...	1.39 × 0.62
Size of body.....	0.045 × 0.008	...	1.13 × 0.20
♀.—Length of antennæ.....	0.020 inch	...	0.50 millimètre.
Expanse of wings.....	0.060 × 0.025	...	1.54 × 0.62
Size of body.....	0.050 × 0.010	...	1.27 × 0.25

♂ and ♀. Antennæ pale brown; ♂ joints sub-globose, alternate joints almost imperceptibly larger than the intermediate ones, rather shorter than the pedicels; short dense verticils; terminal joint with a slender projection: ♀ joints sub-cylindrical, rather

longer than broad, with very short pedicels, verticillate-pilose; terminal joint with a small projection. Vertex with golden hairs. Hypostoma and front pale yellowish. Palpi very slender, yellowish. Thorax ochraceous-brown, rather paler in the ♀, with two rows of long golden hairs; pleuræ pale ochraceous-brown. Halteres yellow, the club large, elongate. Abdomen pale ochraceous, banded with cinereous; dense golden pubescence; ♂ forceps and ♀ ovipositor yellow. Legs moderately long and slender. Coxæ pale ochraceous. Femora pale ochraceous, with a short golden pubescence, and cinereous on the upper side, the latter more distinct in the ♂. Remaining joints cinereous, with pale ochraceous reflections. Articulations golden. Wings considerably more rounded in the ♂ than the ♀, pellucid, very densely haired and ciliated with golden-yellow hairs; reflecting violaceous markings when viewed at a certain obliquity. These spots are very distinct in the ♀ but faint and ill-defined in the ♂, and correspond with those on the wing of *D. dibapha*, except that the nebuloise marking on the apical portion is rather more detached, and the spot immediately below the second longitudinal vein is very indistinct in this species. Second longitudinal vein very little arcuated, reaching the border just beyond the apex of the wing; cross-vein most indistinct; third longitudinal vein turning abruptly towards the posterior border; anterior branch considerably arcuated, indistinct. (Description drawn from dried specimens).

Hab.—Elizabeth Bay (Masters and Skuse). End of December.

51 DIPLOSIS CERTA, sp.n.

♀.—Length of antennæ.....	0.025 inch	...	0.62 millimètre.
Expanse of wings	0.070 × 0.030	...	1.77 × 0.76
Size of body.....	0.050 × 0.010	...	1.27 × 0.25

Antennæ brown, joints sub-cylindrical, sessile, verticillate-pilose. Hypostoma and front pale ochraceous. Palpi very slender, pale ochraceous. Thorax ferruginous-brown, nitidous, with two longitudinal rows of yellowish hairs; humeri and posterior corners

ochraceous; pleuræ deep brown; scutellum ferruginous-brown. Halteres moderately long, stem yellow; club brown, almost pyriform. Abdomen light reddish-brown, with a dark patch on the first three dorsal segments; terminal joint also dark; yellowish pubescence. Legs moderately long, slender, cinereous, articulations pale. Wings pellucid, with a very pale yellowish tint; moderately haired, more dense towards the tip; a rich golden reflection variegated with ill-defined spots of pale yellow or whitish hairs. Three longitudinal almost equidistant spots on the costal vein; a spot just below the third costal, and one at the end of the second longitudinal vein immediately beyond the tip of the wing, a sixth spot below the second longitudinal vein slightly anterior to the second costal spot, a seventh mid-way between the last and the apical spot, and three almost equidistant spots (the last a short distance from the posterior border), along the anterior side of the third longitudinal vein; the last is an irregular arcuation from the posterior margin, up the posterior branch of the third longitudinal vein, extending about half way down the anterior branch, and falling vertically again to the margin. Second longitudinal running rather close to the costa, joining the margin beyond the apex of the wing; cross-vein rather oblique, indistinct; third longitudinal vein indistinct, turning abruptly to the posterior margin; anterior branch most indistinct. (Description drawn from dried specimen).

Hab.—Woronora (Masters and Skuse).

2. Antennæ in the ♂ decorated with long hairs on the upper side.

52. DIPLOSIS VIOLACEA, sp.n.

♂.—Length of antennæ.....	0.110 inch	...	2.79 millimètres.
Expanse of wings.....	0.110 × 0.040	...	2.79 × 1.01
Size of body.....	0.080 × 0.020	...	2.02 × 0.50
♀.—Length of antennæ.....	0.045 inch	...	1.13 millimètres.
Expanse of wings.....	0.140 × 0.050	...	3.55 × 1.27
Size of body.....	0.110 × 0.030	...	2.79 × 0.76

♂ and ♀.—Joints of the flagellum black; pedicels sordid grey; verticils greyish; ♂ with long hair on the upper side; basal joints large, pale brownish; double joints very large, almost pyriform; simple joints as long as the pedicels at the base of the flagellum, pedicels increasing in length, and joints decreasing in size towards the extremity; last joint with a long slender projection: ♀ sub-sessile, sub-cylindrical, three times as long as the pedicels; terminal joint with a small conical process. Front yellowish-brown. Thorax pale brown, nitidous, with long hairs, two rows from the collare to the scutellum; scutellum prominent, sordid brown, with a row of erect hairs. Halteres blackish, pale at the base of the stalk. Abdomen sordid brown, darker superiorly on the first two or three segments. Legs extremely long, slender. Coxæ pale. Femora, tibia, and tarsi blackish, the last joints with a greyish reflection. Wings appearing blackish on account of their dense pubescence, with a beautiful violet reflection, the latter not quite so apparent in the ♂. The costal and the two first longitudinal veins brown; cross-vein rather indistinct; the third longitudinal pale but distinct, anterior branch nearly straight. (Description drawn from dried specimens).

Hab.—Sydney, Woronora, Middle Harbour, and Blue Mountains (Masters and Skuse).

Obs.—This species may frequently be seen, like many of its congeners, in great numbers in caves, hanging upon the long threads of spiders' webs.

53. DIPLOSIS SAXATILIS, sp.n

♂.—Length of antennæ.....	0.120 inch	...	3.04 millimètres.
Expanse of wings.....	0.110 × 0.040	...	2.79 × 1.01
Size of body.....	0.080 × 0.018	...	2.02 × 0.45
♀.—Length of antennæ.....	0.040 inch	...	1.01 millimètres.
Expanse of wings	0.090 × 0.034	...	2.27 × 0.86
Size of body.....	0.075 × 0.020	...	1.89 × 0.50

♂ and ♀.—Antennæ sordid grey; joints darker than the pedicels; basal joints yellowish; verticils moderately long, dense; ♂ pedicels twice as long as the joints; alternate joints larger, two long hairs on each joint on the upper side; terminal joint with a process like half a pedicel; ♀ sub-sessile, sub-cylindrical, more than twice as long as the pedicels: end joint with a small projection. Front pale. Thorax and abdomen greyish or greyish-brown, darker above, with a pale pubescence (♀ abdomen sometimes with a reddish tinge). Halteres blackish, pale at the base and tip of knob. Legs of the ♂ longer than those of ♀, sordid grey, with the tip of the third, and the last two joints of the tarsi hoary. Wings pellucid, with a dense yellowish pubescence and a brassy reflection. Costal border blackish. First longitudinal vein close to the costa, but quite distinct; second longitudinal vein yellowish-brown; transverse vein indistinct; branches of the third longitudinal indistinct. (Description drawn from dried specimens).

Hab.—Elizabeth Bay, Sydney (Masters and Skuse).

54. DIPLOSION CONTIGUA, sp.n.

♂.—Length of antennæ.....	0.100 inch	...	2.54 millimètres.
Expanse of wings.....	0.090 × 0.030	...	2.27 × 0.76
Size of body.....	0.060 × 0.015	...	1.54 × 0.38

Antennæ sordid ochraceous; alternate joints globose and sub-globose or almost ovate, all about the same size; verticils moderately long, dense; stiff hairs on the upper side twice the length of the verticils; pedicels one half longer than a joint; terminal joint with a slender projection. Hypostoma and front sordid ochraceous. Palpi long and slender, pale brown. Thorax smoky ochraceous-brown, nitidous, with the usual two longitudinal rows of hairs separating three darker bands; pleuræ ochraceous-brown; scutellum prominent, ochraceous. Halteres ochraceous at the base, the stalk and club pubescent, cinereous; club large, somewhat elongate. Abdomen ochraceous-brown, the

dorsal segments darker, inclining to umber; clothed with a pale pubescence. Legs long, slender, densely pubescent, almost cinereous; coxæ and femora somewhat ochraceous. Wings densely haired, pellucid, with the faintest bluish tint; brassy reflection. Veins yellowish. Cross-vein very oblique, distinct; third longitudinal indistinct, anterior branch barely distinguishable. (Description drawn from dried specimen).

Hab.—Wheeny Creek, Hawkesbury district (Skuse). January.

Obs.—Closely allied to the preceding.

55. DIPLOSION NEGOTIOSA, sp.n.

♂.—Length of antennæ.....	0·100 inch	...	2·54 millimètres.
Expanse of wings.....	0·090 × 0·035	...	2·27 × 0·88
Size of body.....	0·070 × 0·010	...	1·77 × 0·25
♀.—Length of antennæ.....	0·035 inch	...	0·88 millimètre.
Expanse of wings.....	0·110 × 0·040	...	2·79 × 1·01
Size of body.....	0·060 × 0·020	...	1·54 × 0·50

Antennæ in the ♂ longer than the wings, pale brown; joints sub-globose, alternate joints rather larger; the characteristic long hairs shorter in the larger joints; becoming considerably smaller towards the tip of the flagellum; pedicels rather longer than the joints; ♀ darker brown; cylindrical, sub-sessile; terminal joint with a short narrow projection; verticillate-pilose. Hypostoma and front pale brown. Palpi slender, very pale brown. Thorax in the ♂ pale brown, pale pubescence; collare and humeri ochraceous; pleuræ ochraceous; scutellum pale brown: ♀ deep brown, pale pubescence; collare and humeri pale reddish-brown; pleuræ pale reddish-brown; scutellum pale brown. Halteres pale reddish-brown at the base, the stalk and club with a blackish pubescence, the latter distinctly pyriform. Abdomen in the ♂ umber-brown on the dorsal segments, pale brown underneath and towards the extremity of the body, densely pubescent, particularly about the forceps, the latter large, pale brown: ♀ deep umber-brown superiorly, pale brown underneath, pale pubescence; lamellæ small,

pale brown. Legs long and slender, cinereous, rather longer in the ♀ than in the ♂; coxæ and base of femora in the ♀ pale reddish-brown in the ♀ greyish-yellow. Wings pellucid, very densely haired particularly at the tip, densely ciliated, with roseous and golden reflections, the latter very light in the ♀. First longitudinal vein somewhat wide of the costa, verging gradually into the margin; second longitudinal vein reaching the margin a short distance beyond the apex; cross-vein rather indistinct; third longitudinal vein turning abruptly towards the posterior border, anterior branch pale, nearly straight. (Description drawn from dried specimens).

Hab.—North Willoughby (Masters and Skuse). Beginning of December.

56. DIPLOSIS ACTIOSA sp.n.

♂.—Length of antennæ.....	0·100 inch	...	2·54 millimètres.
Expanse of wings.....	0·090 × 0·040	...	2·27 × 1·01
Size of body.....	0·050 × 0·015	...	1·27 × 0·38
♀.—Length of antennæ.....	0·040 inch	...	1·01 millimètres.
Expanse of wings.....	0·100 × 0·040	...	2·54 × 1·01
Size of body.....	0·055 × 0·020	...	1·39 × 0·50

♂ Antennæ grey, basal joints large, having a somewhat yellowish tinge, flagellar joints small, globate, the alternate ones somewhat larger than the intermediate ones; verticils pale; each joint with a very long stiff hair on the upper side; pedicels increasing in length towards the end, where they are twice the length of the joints, the joints at the same time becoming gradually smaller; terminal joint with a slender projection: ♀ joints brown, cylindrical, sessile, the pedicels very short, basal joints large, yellowish-brown, last joint ending in a small bud-shaped appendage; verticillate-pilose. Hypostoma and front yellowish. Palpi slender, yellowish. Thorax pale yellowish-brown, levigate, with long yellowish hairs; pleuræ and scutellum yellowish. Poisers naked and whitish at the base, the stem and club with brown scales. Abdomen greyish-brown, a dark brownish patch on the first two dorsal

segments, especially prominent in the ♀; densely covered with a pale pubescence. Legs long and slender. Coxæ yellowish. Femora yellowish at the base, anterior half dark grey. Tibiæ and tarsi cinereous, with a paler reflection. Wings pellucid, with a pale bluish tint, very densely haired, and having a rich golden reflection tinged with violet and purple in the ♂, much paler and brassy in the ♀. Veins pale brownish; costal well fringed; transverse vein rather indistinct; second longitudinal vein reaching the margin immediately beyond the apex of the wing; third longitudinal obscure, turning towards the margin in an abrupt rounded angle, anterior branch very indistinct. (Description drawn from dried specimens).

Hab.—Peat's Ferry (Masters and Skuse). August.

57. DIPLOSIS CINERARIA, sp.n.

♂.—Length of antennæ... .. 0.100 inch ... 2.54 millimètres.

Expansion of wings..... 0.090 × 0.030 ... 2.27 × 0.76

Size of body..... 0.050 × 0.015 ... 1.27 × 0.38

Antennæ grey; basal joints large, pale brown; flagellar joints darker than the pedicels, alternate joints only slightly larger, ovate, each joint with long hairs on the upper side, pedicels longer than joints, last joint with a slender projection, verticils pale, rather dense. Hypostoma and front yellowish; palpi slender, yellowish. Thorax smoky, with a yellowish tint on the margins, nitidous, two rows of erect greyish hairs; scutellum yellowish-brown, haired; pleuræ yellowish-brown. Halteres black, whitish at the base of the stalk and tip of knob. Abdomen pale greyish-brown, covered with long erect greyish hairs, darker posteriorly on the first two or three segments. Legs cinereous, with a lighter reflection. Wings with a pale bluish tint, thickly haired, and having a brassy reflection. The costal and two first longitudinal veins pale; cross-vein indistinct; third longitudinal very indistinct, appearing only as a pale yellowish line lying in the longitudinal fold, posterior branch equally indistinct. (Description drawn from a dried specimen).

Hab.—Woronora (Masters and Skuse). October.

58. DIPLOSIS INDOTATA, sp.n.

♂.—Length of antennæ.....	0.070 inch	...	1.77 millimètres.
Expanse of wings.....	0.065×0.025	...	1.66×0.62
Size of body.....	0.040×0.010	...	1.01×0.25

Antennæ grey, joints rather darker than the pedicels, alternate joints somewhat larger, ovate; each joint with long stiff hairs on the upper side, pedicels longer than the joints, terminal joint with a slender projection, verticillate hairs moderately long and rather pale, basal joints sub-globular, brownish-grey, no larger than the flagellar joints. Hypostoma and front pale brownish; palpi very pale brownish, slender. Thorax dull yellowish-brown, with some long greyish hairs. Poisers black, the base yellowish. Abdomen greyish-brown on the anterior segments, the hinder segments dull yellowish-brown, densely covered with a long, bent, pale pubescence. Legs cinereous. Wings pellucid, with a pale yellowish tint, closely haired, costal and posterior angle deeply ciliated, with a weak brassy reflection. Veins pale brown. First longitudinal vein close to the costa; cross-vein pale, rather indistinct, long, not very oblique; second longitudinal vein considerably curved exteriorly, reaching the margin beyond the tip of the wing; third very indistinct. (Description drawn from dried specimen).

Hab.—Middle Harbour (Skuse). In November.

59. DIPLOSIS OREAS, sp.n.

♂.—Length of antennæ.....	0.090 inch	...	2.27 millimètres.
Expanse of wings.....	0.090×0.035	...	2.27×0.88
Size of body.....	0.070×0.020	...	1.77×0.50

Antennæ brownish, double joints about one and a half times as long as the simple ones; all the joints provided with long erect hairs above; pedicels of the double joints shorter; verticillate hairs not very dense, moderately long; basal joints pale brown; terminal process long and slender. Palpi sordid yellowish-brown. Thorax dull brownish, hinder margins and scutellum tinged with

ochraceous; short yellowish hairs in two longitudinal rows from the collare to the scutellum; pleuræ sordid brown. Halteres brownish, pale at the base of the stalk. Abdomen deep umber-brown, with long somewhat brownish and almost straight hairs; forceps paler brown, densely haired. Legs long, slender. Coxæ pale brown. Femora pale brown at the base, anterior half thickly covered with dark, almost sooty, scales. Tibiæ and tarsi appearing greyish-brownish. Wings pellucid, with a pale brown tint; pubescence dense, yellowish, the hairs very little bent; golden reflection, with a purplish tinge. Veins yellowish-brown. First longitudinal vein near to the costa and with it thickly haired; cross-vein indistinct; second longitudinal vein bent towards its end and reaching the margin of the wing immediately beyond the apex; third longitudinal pale, turning towards the margin at an obtuse rounded angle, anterior branch straight, a little bent upwards at the base. (Description drawn from dried specimen).

Hab.—Glenbrook, Blue Mountains (Masters). January.

Sub-genus 4. ASPHONDYLIA, Loew.

Asphondylia, H. Loew, D.B. IV. 1850, p. 21; Winnertz, L.E. 1853, p. 187; Rondani, Prodrum I. 1856, p. 199, &c.; O-Sacken, Mon. Dipt. N. America, 1862, p. 176; Schiner, F.A. II. 1864, p. 395; Liroy, Class. 1863-64, p. 503 (*Cylindrocera*).

Second longitudinal vein reaching the margin of the wing a little beyond the apex (Pl. II., fig. 8). Antennæ of both sexes with the same number of joints; joints cylindrical, sessile, with a short pubescence only.

60. ASPHONDYLIA LOEWI, sp.n.

♀.—Length of antennæ.....	0·040 inch	...	1·01 millimètres.
Expanse of wings.....	0·100 × 0·045	...	2·54 × 1·13
Size of body.....	0·090 × 0·025	...	2·27 × 0·62

Antennæ brown, 2- + 12-jointed, joints sessile, cylindrical, densely covered with a very short pale pubescence, joints decreasing in length towards the tip, the last joint apparently with a very

small nipple-shaped process. Labium and front brownish; palpi yellowish-grey. Thorax dark fuscous, minutely scabrous, somewhat shining, two rows of long erect yellowish hairs from the collare to the scutellum; humeri yellowish; collare and scutellum yellowish-brown. Halteres greyish, yellowish at the base, closely haired. Abdomen almost fuliginous, appearing lighter on account of its pale pubescence. Legs long and robust, greyish-brown, hoary when viewed in a certain light. Wings greyish-brown at the base, hyaline, very densely covered with a long and somewhat interwoven pubescence; dull margaritaceous reflections. Costal pale brown, thickly haired; two first longitudinal veins pale brown; second longitudinal vein slightly curved exteriorly, reaching the margin immediately below the apex of the wing; cross-vein very indistinct; third longitudinal pale. (Description drawn from dried specimen).

Hab.—Como (Masters and Skuse). September.

61. ASPHONDYLIA RUBICUNDA, sp.n.

♂.—Length of antennæ.....	0.050 inch	...	1.27 millimètres.
Expanse of wings.....	0.075 × 0.030	...	1.89 × 0.76
Size of body.....	0.080 × 0.020	...	2.02 × 0.50

Antennæ brown, 2- + 12-jointed, basal joints yellowish-brown; joints of flagellum stout, sessile, cylindrical, more than twice as long as broad, densely covered with a very short greyish pubescence. Hypostoma and front pale reddish-brown. Palpi yellowish brown. Thorax nitidous, sordid yellowish-brown, with two rows of erect hairs enclosing a pale reddish-brown space; humeri pale reddish-brown; pleuræ and collare pale reddish-brown. Halteres pale reddish-brown, with a sparse pubescence. Abdomen pale reddish-brown, the terminal segments paler than the preceding ones, pale pubescence; forceps sordid yellowish-brown, densely haired. Legs short and robust. Coxæ pale reddish-brown. Femora yellowish-brown, upper side and tip blackish. Tibiæ and tarsi cinereous. Wings reddish-brown at

the root, densely haired; pale margaritaceous reflections. The costal and two first longitudinal veins pale brown; second longitudinal vein almost straight, joining the margin at the apex of the wing; third longitudinal vein pale; transverse vein very indistinct. (Description drawn from fresh specimen).

Hab.—Elizabeth Bay (Masters). December.

Sub-genus 5. *HORMOMYIA*, Loew.

Hormomyia, H. Loew, D.B. IV. 1850, p. 20; Winnertz, L.E. 1853, p. 188; Rondani, Stirp. Cec. 1860, pp. 287 and 293; O.-Sacken, Mon. Dipt. N. America, 1862, p. 176; Schiner, F.A. II. 1864, p. 396.

Second longitudinal vein reaching the margin of the wing at or beyond the apex (Pl II, fig. 9). Thorax more or less gibbose, frequently extending over the head in the form of a hood. Antennæ pedicelled in the ♂; pedicelled or sessile in the ♀; number of joints varying from 2+12 to 2+34.

a. *Thorax more or less gibbose.*

62. *HORMOMYIA LUTULENTA*, sp.n.

♂.—Length of antennæ..... 0·070 inch ... 1·77 millimètres.
 Expansé of wings..... 0·110 × 0·040 ... 2·79 × 1·01
 Size of body..... 0·070 × 0·010 ... 1·77 × 0·25

Antennæ pale brown, as long as the body, 2+12-jointed, the joints double, sub-cylindrical, rather longer than the pedicels, with long straight verticils; joints gradually becoming smaller towards the tip, last joint conical. Palpi short, pubescent. Thorax moderately gibbose, reddish-brown, nitidous, with a yellowish pubescence; scutellum almost round, pubescent, dull yellowish-brown; pleuræ dull yellowish-brown. Halteres yellowish at the base, the stalk with a brownish pubescence; club somewhat pyriform, yellowish. Abdomen deep reddish-brown, densely

clothed with a yellowish or brownish-yellow pubescence. Legs moderately long and slender, ochraceous, with a pale pubescence. Wings pellucid, with a very pale brown tint; densely covered with a somewhat interwoven pubescence, deeply ciliated on the posterior angle, and reflecting margaritaceous tints when viewed at a certain obliquity. Veins brown, the costal thickly haired. First longitudinal vein wide of the costa, joining more than half way to the apex of the wing; second longitudinal vein bent exteriorly after leaving the cross-vein, joining the margin immediately beyond the apex of the wings; cross-vein distinct, rather oblique, situated at a point about two-thirds of the length of the first longitudinal vein from the base; third longitudinal vein very indistinct, the anterior branch almost invisible. (Description drawn from dried specimen).

Hab.—Elizabeth Bay (Skuse).

b. *Thorax extending over the head in the form of a hood.*

Sub-genus 6. NECROPHLEBIA, sub-gen. nov.

Second longitudinal veins straight before the cross vein, reaching the margin of the wing beyond its tip (Pl. II., fig. 10). Cross-vein not very oblique. Third longitudinal vein without an anterior branch. Antennæ in the ♀ 2-+12-jointed, joints sub-cylindrical, pedicelled; two sparse verticils on each joint.

63. NECROPHLEBIA VOLITANS, sp.n.

♀.—Length of antennæ.....	0.050 inch	...	1.27 millimètres.
Expanse of wings.....	0.150 × 0.060	...	3.80 × 1.54
Size of body.....	0.100 × 0.030	...	2.54 × 0.76

Antennæ sordid grey, 2-+12-jointed, joints sub-cylindrical, darker than and twice as long as the pedicels, two verticils to each joint, hairs somewhat sparse, light, and not very long, basal joints brown, the first more than twice the length of, and thicker than the second. Labium and palpi faded yellowish or brownish-yellow; the three first joints of the palpi of the same length, almost cylindrical, the fourth joint one-half longer than the others and more slender. Thorax brownish-red, levigate, with two rows

of yellowish hairs; scutellum paler, villose; pleuræ darker than the scutellum, pale brownish-red. Halteres greyish, the knob much darker than the stalk. Abdomen brownish-red, the last two or three segments lighter, with a yellowish pubescence. Legs pinkish-yellow, joints slightly tipped with brownish-red. Wings hyaline, thickly covered with a somewhat long and bent pubescence, and having a margaritaceous reflection. Veins pale brownish. Costal very strong, thickly haired; first and second longitudinal veins paler than the costa, second longitudinal vein reaching the wing-margin beyond its tip; cross-vein pale, but distinct; third longitudinal vein becoming paler towards its end, though visible throughout its length; no anterior branch. (Description drawn from dried specimen).

Hab.—Middle Harbour (Skuse) and Woronora (Masters).

Obs.—The structure of the antennæ, palpi, and ovipositor seems to exhibit the closest approach to *Hormomyia*. The wing is in shape very much like that of *Asynapta pectoralis* figured by Winnertz (Linnæa Entomol. viii., 1853); the venation, however, is similar to that ordinarily seen in the wing of *Diplosis*, but wanting an anterior branch to the third longitudinal.

Sub-genus 7. CHASTOMERA, sub-gen. nov.

First longitudinal vein very wide of the costa; second longitudinal vein reaching the margin beyond the apex of the wing; cross-vein long, a little oblique, situated a short distance from the tip of the first longitudinal vein; third longitudinal with no trace of an anterior branch (Pl. II., fig. 11). Antennæ in the ♀ pedicelled, verticillate.

64. CHASTOMERA BELLA, sp.n.

♀.—Length of antennæ.....	0·070 inch	...	1·77 millimètres.
Expanse of wings.....	0·140 × 0·050	...	3·55 × 1·27
Size of body	0·130 × 0·025	...	3·30 × 0·62

Antennæ half as long as the wings, 2- + 14-jointed; basal joints light reddish-brown; second basal joint almost globose; flagellar joints niveous, almost pyriform, with numerous whorls of hair,

the basal whorl much longer than the rest; terminal joint with a slender projection; pedicels not quite the length of the joints. Hypostoma and front reddish-brown. Palpi long, thickly haired, ochraceous-ferruginous; first joint twice as long as the second; second and third joints thicker, of equal length; last joint slender, one-half longer than the second or third, curved. Thorax reddish-ochraceous, nitidous; two rows of white hairs from the collare to the scutellum; a few long erect white hairs in front of the wings; scutellum prominent, rounded-oblong, with a greyish tint. Poisers niveous, with silvery white hairs; club gradually thickened. Abdomen acuminate, nitidous, cretaceous-white, with a silvery white pubescence; lamellæ small, niveous, with fine silvery white hairs. Legs moderately long, niveous, densely clothed with very long semi-erect silvery white hairs; a sooty-black ring just before the tip of the femora, another at the tip of the tibiæ, a third almost covering the first small tarsal joint, and a broader and paler ring at the tips of the next three following joints. Wings large, very densely covered with somewhat interwoven hairs surrounded by short dense cilia; hairs and veins niveous; the costal vein with a sooty-black spot just before the joining of the first longitudinal vein, the underlying portion of the first and second and longitudinal veins and the whole of cross-vein sooty-black, also a correspondingly broad but lighter spot towards the tip of the third longitudinal vein; surface of wing with a pale bluish reflection, very faint on account of its dense pubescence. First longitudinal vein very wide of the margin, joining the costa beyond the middle; second longitudinal vein considerably bent exteriorly after leaving the cross-vein, reaching the margin much beyond the apex of the wing; cross-vein somewhat oblique, most distinct, situated a short distance from the tip of the first longitudinal vein, and at a point more than three-fourths of the length of the latter from the base; third longitudinal vein most distinct, starting a short distance from the base of the second longitudinal vein, very little arcuated, reaching the posterior border about half-way to the tip; no trace of an anterior branch. (Description drawn from fresh specimen).

Hab.—Gosford (Skuse). February.

Obs.—I have taken only one specimen of this eminently distinct form; and it is without doubt the most beautiful of all the known Australian Cecidomyidæ. It appears to have a close affinity to *Necrophlebia*, but the examination of further specimens may alter my conviction.

Sub-genus 8. COLPODIA, Winnertz.

Colpodia, Winnertz, L.E. 1853, p. 188; O.-Sacken, Mon. Dipt. N. America, 1862, p. 176; Schiner, F.A. II. 1864, p. 409.

Second longitudinal vein forming a curve before the cross-vein, and joining the margin a little beyond the apex of the wing (Pl. II., fig. 12). Cross-vein large, oblique. Antennæ pedicelled in both sexes; the number of joints uncertain; joints verticillate.

65. COLPODIA INDUBITATA, sp.n.

♂.—Length of antennæ..... 0·065 inch ... 1·64 millimètres.

Expanse of wings..... 0·065 × 0·020 ... 1·64 × 0·50

Size of body..... 0·050 × 0·010 .. 1·27 × 0·25

Antennæ pale brown, 2-+14-jointed, joints sub-cylindrical, towards the tip appearing almost ovate, separated by pedicels longer than the joints; verticillate hairs sparse, very long and fine; basal joints large. Palpi yellowish-brown. Thorax ochraceous-brown, levigate, two rows of yellowish-brown hairs; pleuræ and scutellum sordid yellow. Halteres yellow at the base, the stalk and club densely covered with a brown pubescence, gradually incrassate. Abdomen slender, slightly tapering, first three segments ochraceous-brown, the rest yellowish above and ochraceous-brown underneath, densely pubescent. Legs long and slender, of a uniform sordid yellow, densely clothed with a fine pubescence. Wings narrow, moderately haired on the surface, margins sparingly ciliated; roseous reflections. Veins yellowish; costal vein thick; first longitudinal vein close to the costal; cross-vein distinct, joining the first longitudinal vein about the middle second longitudinal vein prominent, reaching the margin

considerably below the apex of the wing; third longitudinal vein running close to the posterior margin, indistinct, particularly at its extremity. (Description drawn from dried specimen).

Hab.—Middle Harbour (Skuse). September.

Obs.—I believe this is only the second species of the genus known. Winnertz described the first-discovered species from Germany, and established this genus in 1853.

Sub-section B.

Cross-vein very oblique, originating at the root of the first longitudinal vein.

Sub-genus 9. DIRHIZA, Loew.

Dirhiza, H. Loew, D.B. IV. 1850, p. 21; Winnertz, L.E. 1853, p. 186; Rondani, Stirp. Cec. 1860, pp. 287 and 293; O.-Sacken, M. Dipt. N. America, 1862, p. 176.

Second longitudinal vein hardly undulating before the cross-vein; joints of the antennæ sessile or almost sessile in both sexes.

Obs.—Only a single species has been described, *D. lateritia*, from Europe.

Sub-genus 10. EPIDOSIS, Loew.

Epidosis, H. Loew, D.B. IV. 1850, p. 21; Rondani, 11^{da} Mem. Parma, 1840, &c.; Winnertz, L.E. 1853, pp. 186 and 189; O.-Sacken, Mon. Dipt. N. America, 1862, pp. 176 and 177; Schiner, F.A. II. 1864, p. 402.

Second longitudinal vein sinuose before the cross-vein (Pl. II., fig. 13); joints of the antennæ pedicelled in both sexes; their number variable.

66. EPIDOSIS DISTENTA, sp.n.

♀.—Length of antennæ..... 0.050 inch ... 1.27 millimètres.
 Expanse of wings..... 0.140 × 0.045 ... 3.55 × 1.13
 Size of body..... 0.080 × 0.020 ... 2.02 × 0.50

Antennæ rather longer than the head and thorax, pale brown, 2-+11-jointed, the joints long, sub-cylindrical, with long verticillate hairs; pedicels very short Front and palpi pale brownish, the

palpi nearly half as long as the antennæ. Thorax pale, somewhat reddish-brown, nitidous, with long erect hairs; humeri and anterior border, scutellum, and pleuræ ochraceous. Halteres long, slender, yellowish. Abdomen light umber-brown, very densely clothed with pale semi-erect hairs. Legs very long and slender, densely haired. Coxæ pale reddish-brown. Femora and tibiæ pale umber-brown. Tarsi pinkish from the tip of the second joint, and having a hoary reflection. Wings hyaline, very thickly covered with a somewhat interwoven pubescence; dull roseous and brassy reflections; moderately ciliated. Veins brown. First and second longitudinal veins very distinct, the latter reaching the margin below the apex of the wing. Cross-vein distinct. Third longitudinal vein pale and rather indistinct, turning abruptly towards the posterior border; anterior branch curving upwards from the posterior branch, then taking a straight course. (Description drawn from dried specimen).

Hab.—Elizabeth Bay (Skuse). Beginning of December.

67. EPIDOSIS MAGNIFICA, sp.n.

♂.—Length of antennæ.....	0.100 inch	...	2.54 millimètres.
Expanse of wings.....	0.140 × 0.040	...	3.55 × 1.01
Size of body.....	0.060 × 0.020	...	1.54 × 0.50

Antennæ whitish with a tinge of yellow towards the base, 2- + 20-jointed; basal joints pale brown; first joints pale brown; first basal joint very large; flagellar joints more than half as long as the pedicels, sub-cylindrical, rather longer than broad, ornamented with whorls of extremely long hairs; joints and pedicels becoming smaller towards the tip, last joint very slender, sub-sessile. Hypostoma and front brownish-yellow, palpi very long, covered with hairs, brownish-yellow. Thorax brown with a greyish reflection, two longitudinal rows of pale semi-erect hairs; humeri and anterior margin ochraceous; pleuræ ochraceous-brown; scutellum ochraceous, with pale hairs. Halteres long, stalk slender, yellowish at the base; club globose, dusky. Abdomen reddish-brown, densely covered with a pale pubescence; pincers darker.

Legs very long, slender, greyish, with paler articulations; two last joints of the tarsi pale saffron-yellow, with a hoary reflection. Wings pellucid, with a pale bluish tint, thickly haired, densely and moderately deeply ciliated; reflections pale aurichalceous. First longitudinal at first wide of the costa, running gradually into it at beyond a third of the distance from the tip of the wing; cross-vein almost straight and parallel with the first longitudinal; second longitudinal very sinuose before reaching the cross-vein, and at that point almost touching the first longitudinal vein, joining the margin beyond the apex of the wing; third longitudinal with its branches indistinct. (Description drawn from dried specimen).

Hab.—Elizabeth Bay (Masters). January.

68. EPIDOSIS GRACILIS, sp.n.

♂.—Length of antennæ.....	0.110 inch	...	2.79 millimètres.
Expanse of wings.....	0.130 × 0.040	...	3.30 × 1.01
Size of body.....	0.070 × 0.015	...	1.77 × 0.38

Antennæ brownish-yellow, 2-+14-jointed; basal joints subglobose; flagellar joints on the basal half cylindrical, more than twice as long as broad; towards the tip becoming shorter, subcylindrical; terminal joint rudimentary, conical, sessile; pedicels at the base as long as the joints, towards the tip almost twice their length; verticils long. Thorax deep brown, nitidous, with brownish hairs; humeri yellowish; pleuræ brownish-yellow; scutellum brownish-yellow, with long erect hairs. Halteres long, densely haired, the club large, pyriform. Abdomen dusky-brown, densely haired; the last segment with light reddish-brown forceps. Legs long and slender, dusky-yellow; tip of the third, and the fourth and fifth tarsal joints pale yellowish, with a hoary reflection. Wings pellucid, with a very pale bluish tint, densely pubescent, particularly at the tip; brassy reflection, chalybeous along the venation. Cross-vein very pale, almost straight, diverging from the first longitudinal at its tip; second longitudinal not very

sinuose before the cross-vein, at the joining of the cross-vein only a very short distance from the first longitudinal, and reaching the wing-margin beyond the apex; both branches of the third longitudinal vein very indistinct. (Description drawn from dried specimen).

Hab.—Elizabeth Bay (Skuse).

69. EPIDOSIS OPIPARA, sp.n.

♀.—Length of antennæ.....	— inch	...	— millimètres.
Expansion of wings.....	0.100 × 0.040	...	2.54 × 1.01
Size of body.....	0.070 × 0.020	...	1.77 × 0.50

Antennæ yellowish (number of joints not known, a portion being broken off both antennæ), joints cylindrical, rather longer than broad, verticillate-pilose, about four times as long as the pedicels. Palpi yellowish. Thorax faded reddish-brown, pale hairs; humeri whitish; scutellum whitish, with a few long pale hairs. Halteres whitish, stalk long and slender, club somewhat small and almost globose. Abdomen greenish-yellow, with pale hairs; ovipositor long, with a brownish tinge. Legs long and slender. Coxæ sordid yellowish. Femora whitish for the greater part of their length, terminating with yellowish-grey. Tibiæ and tarsi yellowish-grey. Wings pellucid, with a very faint bluish tint; densely haired, particularly at the tip; and bright purple and violet reflections. Cross-vein pale, almost straight; second longitudinal vein very sinuose before the cross-vein, meeting the cross-vein close to the first longitudinal, joining the margin of the wing beyond the apex; third longitudinal vein indistinct. (Description drawn from dried specimen).

Hab —Elizabeth Bay (Masters).

70. EPIDOSIS CONFERTA, sp.n.

♀.—Length of antennæ.....	0.060 inch	...	1.54 millimètres.
Expansion of wings.....	0.100 × 0.040	...	2.54 × 1.01
Size of body.....	0.070 × 0.010	...	1.77 × 0.25

Antennæ rather more than half the length of the wings, brownish-yellow, 2- + 11-jointed, the last one small and rudimentary; joints more than twice as long as broad, cylindrical; moderately long verticils; pedicels at the base longer than the joints, towards the tip gradually becoming smaller, that of the terminal joint very small. Thorax yellowish-brown, with two rows of brownish hairs from the collare to the scutellum; humeri pleuræ and scutellum ochraceous. Poisers yellowish, with a dusky pubescence, stalk slender, club elongate. Abdomen dirty-yellow, pale between the segments; pale pubescence; ovipositor apparently short. Legs long, somewhat robust. Coxæ ochraceous. Femora yellowish-grey, darker along the front side. Tibiæ, first tarsal joint and greater part of the second yellowish-grey, remainder yellow, becoming paler towards the end of the last joint. Wings densely and evenly haired, deeply ciliated on the posterior border, with pale violaceous reflections. First longitudinal vein long, rather closely approximated to the costa; cross-vein rather indistinct, visible at the joining as a short very oblique vein; second longitudinal vein hardly sinuose at the base, bending anteriorly close to the first longitudinal at the cross-vein, reaching the margin beyond the apex of the wing; third longitudinal most indistinct. (Description drawn from dried specimen).

Hab.—Elizabeth Bay (Masters).

71. EPIDOSIS PEREXILIS, sp.n.

♂.—Length of antennæ.....	0·100 inch	...	2·54 millimètres.
Expanse of wings	0·120 × 0·040	...	0·50 × 1·01
Size of body	0·060 × 0·010	...	1·54 × 0·25

Antennæ pale yellow, 2- + 19-jointed, terminal joint rudimentary, sessile; joints of the flagellum sub-cylindrical, at the base almost sub-globose, same length and breadth, towards the end smaller, longer than broad, very long whitish verticils, pedicels a little longer than the joints. Palpi moderately long, pale brownish,

with a light pubescence. Thorax ochraceous, nitidous, with pale hairs; collare, pleuræ and scutellum ochraceous. Halteres whitish, stalk slender, club elongate. Abdomen yellow, with a pale pubescence. Legs very long, slender. Coxæ yellowish; remaining joints white. Wings pellucid, with a very pale bluish tint; densely haired, especially towards the tip; and a pale silvery reflection. Veins whitish. First longitudinal parallel with the costa for two-thirds of its length, then gradually merging into the margin; cross-vein and second longitudinal vein very distinct, one continuous straight line, close to and parallel with the first longitudinal at the base, bending exteriorly at about two-thirds of its length, joining the wing-margin beyond the apex; the sinuose portion is very undulated, very pale, and appears not part of the second longitudinal vein; third longitudinal vein very pale and indistinct; anterior branch only distinguishable with difficulty. (Description drawn from dried specimen).

Hab.—Elizabeth Bay (Skuse).

72. EPIDOSIS PALLIDA, sp.n.

♂.—Length of antennæ.....	0.080 inch	...	2.02 millimètres.
Expanse of wings.....	0.080 × 0.030	...	2.02 × 0.76
Size of body.....	0.050 × 0.008	...	1.27 × 0.20
♀.—Length of antennæ.....	0.050 inch	...	1.27 millimètres.
Expanse of wings.....	0.100 × 0.040	...	2.54 × 1.01
Size of body.....	0.070 × 0.010	...	1.77 × 0.25

Antennæ yellowish; ♂ 2-+14-jointed, joints sub-cylindrical, rather longer than broad, with very long verticillate hairs, on pedicels about one and a-half times as long as a joint, becoming gradually smaller towards the tip, terminal joint conical, sessile: ♀ 2-+11-jointed, joints almost fusiform, verticillate-pilose, three times as long as the pedicels. Palpi and front yellowish. Thorax light brown, with rather long yellowish hairs; humeri yellowish; pleuræ ochraceous-brown; scutellum yellowish-white with a few hairs. Halteres somewhat short, densely haired, club

pyriform. Abdomen ochraceous-brown, covered with a pale, yellowish pubescence; ♀ ovipositor short. Legs long and slender, greyish-yellow, with a dense pubescence, appearing somewhat longer in the ♂. Wings pellucid, with a pale bluish tint, thickly and uniformly haired, moderately ciliated, with roseous and golden reflections when viewed at a certain obliquity. Veins yellowish-brown. Membrane of wing tinted with brown between the costa and the first longitudinal vein. Cross-vein very oblique, not discernible for more than a fourth of its length from the second longitudinal vein; second longitudinal vein a little sinuose before the cross-vein, joining the margin just beyond the tip of the wing; third longitudinal vein turning rather abruptly towards the posterior margin; anterior branch indistinct. (Description drawn from dried specimens).

Hab.—Elizabeth Bay (Skuse). July.

73. EPIDOSIS MACELLA, sp.n.

♀.—Length of antennæ.....	0.035 inch	...	0.88 millimètre.
Expanse of wings.....	0.070 × 0.025	...	1.77 × 0.62
Size of body.....	0.050 × 0.010	...	1.27 × 0.25

Antennæ brownish-yellow, 2-+11-jointed, joints almost fusiform, verticillate-pilose, sub-sessile; terminal joint sessile. Palpi and front yellow. Thorax somewhat brownish-yellow, with yellow hairs; humeri whitish; pleuræ yellow; scutellum small and narrow, yellowish-white. Halteres yellowish, white at the base, slightly increasing in thickness towards the apex, but hardly clubbed. Abdomen yellow, densely covered with a yellowish pubescence; ovipositor short; lamellæ very small, elongate, yellowish. Legs moderately long, slender, almost brownish-yellow, very densely haired. Wings pellucid, with a pale bluish tint, not densely haired, thicker towards the apex, almost uniformly ciliated round the whole margin; bright brassy reflection. First longitudinal near the costa, imperceptibly joining; second longitudinal vein hardly sinuose before the cross-vein, and not so

well defined or appearing part of the remainder of the vein, joining the wing-margin at or immediately below the apex ; cross-vein and second longitudinal apparently continuous, the former very oblique ; third longitudinal vein very indistinct, particularly the anterior branch. (Description drawn from dried specimen).

Hab.—Sydney (Skuse).

74. *EPIDOSIS EXIGUA*, sp.n.

♀.—Length of antennæ.....	0·030 inch	...	0·76 millimètre.
Expanse of wings.....	0·070 × 0·035	...	1·77 × 0·88
Size of body.....	0·050 × 0·010	...	1·27 × 0·25

Antennæ pale brown, 2- + 11-jointed ; joints cylindrical, twice as long as broad, verticillate-pilose, longer than the pedicels ; pedicels pale ; terminal joint sessile. Palpi short, rather thick, brownish-yellow. Hypostoma and front brownish-yellow. Thorax pale brown, with the usual two rows of brownish-yellow hairs ; pleuræ pale brown ; scutellum somewhat yellowish-brown ; humeri same colour as the thorax. Halteres ochraceous, rather short, densely covered with minute yellow hairs, club elongate, scarcely pyriform. Abdomen yellowish-brown, reddish-brown towards the extremity, thickly haired. Legs moderately long, slender, yellow, densely covered with long and short hairs. Wings broad, pellucid, with a pale bluish tint, covered with a rather dense and somewhat interwoven pubescence ; moderately ciliated ; with roseous and golden reflections. First longitudinal vein wide of the costa and parallel with it, then joining the margin at an acute angle ; cross-vein a short distance from and almost parallel with the first longitudinal vein, and forming with the second longitudinal vein one continuous straight line ; second longitudinal very sinuose at the base, and much paler than the rest of the vein, reaching the margin just beyond the apex of the wing ; third longitudinal vein wide of the margin, bending gradually into the posterior border ; no trace of an anterior branch. (Description drawn from dried specimen).

Hab.—Glenbrook, Blue Mountains (Masters).

75. EPIDOSIS GIBBEROSA, sp.n.

♀.—Length of antennæ.....	0.040 inch	...	1.01 millimètres.
Expanse of wings	0.080 × 0.030	...	2.02 × 0.76
Size of body	0.070 × 0.015	...	1.77 × 0.38

Antennæ light reddish-brown, 2- + 11-jointed, half the length of the wings; first basal point almost pyriform, twice as long as the second, the latter globose; flagellar joints almost fusiform, with a clavate pedicel at the apical end; joints three times as long as the pedicels; verticels sparse, moderately long. Thorax considerably gibbose; light umber-brown, nitidous, with yellowish hairs; pleuræ dull ochraceous-brown; scutellum paler umber than the thorax, prominent, rounded-oblong. Poisers ochraceous-brown. Abdomen umber brown, with yellowish hairs; ovipositor apparently short, no visible lamellæ. Legs moderately long, robust, umber brown, thickly haired; tip of the fourth and remaining joints of the tarsi white; third tarsal joint very little longer than the fourth. Wings pellucid, with a very pale brownish tint, anterior margin with a dense moderately long uniform fringe from the base to the end of the second longitudinal vein. First longitudinal vein rather close to the costa; second longitudinal vein a little sinuose before the transverse vein, reaching the margin immediately beyond the apex; cross-vein distinctly visible from the root of the first longitudinal; third longitudinal vein almost straight, anterior branch scarcely distinguishable, close to the posterior border (Pl. II., fig. 14). (Description drawn from dried specimen).

Hab.—Elizabeth Bay (Masters).

Obs.—This description was drawn from two imperfect specimens, but they belong to such a distinct species that it cannot fail to be recognised from the above; it almost appears to me that this species should inaugurate a new sub-genus.

Section II.

Wings with four longitudinal veins.

Sub-genus 11, *ASYNAPTA*, Loew.

Asynapta, H. Loew, D.B. IV. 1850, p. 21; Winnertz, L.E. 1853, p. 189; Rondani, Stirp. Cec. 1860, pp. 287 and 293; O-

Sacken, Mon. Dipt. N. America, 1862, p. 177 ; Schiner, F.A. II. 1864, p. 405.

Cross-vein sometimes as in section A, then the second longitudinal vein is not sinuated ; sometimes as in section B, and then the second longitudinal vein is sinuated (as in *Epidosis*) ; in this case also the collare is a little prolonged (Pl. III., figs. 15 and 16).

a. *Second longitudinal vein and cross-vein as in Epidosis.*

76. ASYNAPTA FLAMMULA, sp.n.

♀.—Length of antennæ.....	0·020 inch	...	0·50 millimètre.
Expanse of wings.....	0·090 × 0·040	...	2·28 × 1·01
Size of body.....	0·058 × 0·018	...	1·47 × 0·45

Antennæ brownish, 2-+16-jointed, moniliform ; joints sub-globular, gradually decreasing in size towards the tip ; no visible pedicels ; the verticillate hairs short and rather light. Head brownish, with a few light hairs. Palpi yellowish-brown. Thorax reddish-brown ; collare brownish ; pleuræ yellowish-brown. Halteres short, pear-shaped, yellowish-brown, thickly covered with fine hairs. Legs moderately long, yellowish, with a short delicate pubescence having a whitish reflection. Abdomen light reddish-brown, with a fine pubescence. Wings iridescent, with a fiery reflection when viewed in a certain light, rather thick pubescence ; moderately long fringe on the anterior and posterior margins and posterior angle ; costal vein pale brownish ; first longitudinal vein short, wide of the margin ; second longitudinal vein sinuose before the cross-vein, joining the border of the wing about the apex ; third longitudinal vein most indistinct throughout its length, particularly at the base, only very little curved exteriorly towards its end, reaching the border of the wing a short distance below the apex ; fourth longitudinal vein rather indistinct, but more apparent than the last, turning towards the posterior margin in an obtuse rounded angle. (Description drawn from dry specimen).

Hab.—Sydney (Masters).

b. *Second longitudinal vein and cross-vein as in Diplosis.*

77. *ASYNAPTA PRISCA*, sp.n.

♂.—Length of antennæ.....	0·080 inch	...	2·02 millimètres.
Expanse of wings.....	0·110 × 0·045	...	2·79 × 1·13
Size of body.....	0·100 × 0·027	...	2·54 × 0·67

Antennæ greyish, 2-+12-jointed, joints sub-cylindrical, thick, longer than the pedicels; pedicels paler than the joints; verticillate hairs greyish, very long, rather dense, straight; basal joints somewhat flattened, the first larger than the second. Hypostoma and front brown; palpi brown, thick, very hairy. Thorax deep reddish-brown, appearing almost black, nitidous, with a dispersed pubescence. Halteres yellowish, the base of the club with a brownish tinge. Abdomen deep reddish-brown, the red predominating on the dorsal segments, sparingly haired. Legs long and slender. Coxæ yellowish-brown. Femora, tibiæ, and tarsi yellowish, with a close pubescence, appearing greyish in an oblique direction. Wings yellowish-brown at their insertion, densely clothed with long hairs, moderately ciliated on the posterior border, and having very little reflection. Veins pale; first longitudinal vein wide of the costa, reaching the margin half-way to the tip; second longitudinal vein not sinuated before the cross-vein, joining the costal immediately beyond the apex of the wing; transverse vein distinct, very oblique, running parallel to the first longitudinal for half its length before joining; third longitudinal vein rather indistinct at the base, very little curved exteriorly; fourth longitudinal very distinct, turning towards the margin in an obtuse rounded angle. (Description drawn from fresh specimen).

Hab.—Elizabeth Bay (Masters). Beginning of December.

78. *ASYNAPTA PARIETINA*, sp.n.

♀.—Length of antennæ.....	0·025 inch	...	0·62 millimètre.
Expanse of wings.....	0·070 × 0·030	...	1·77 × 0·76
Size of body.....	0·060 × 0·015	...	1·54 × 0·38

Antennæ almost cinereous, 2- + 12-jointed, about as long as the head and thorax, joints rather longer than wide, sessile, with very short verticillate hairs, basal joints small, yellowish-brown. Hypostoma and front yellowish-brown. Palpi yellowish-brown. Thorax black, slightly pubescent; pleuræ sordid yellowish-brown; scutellum yellowish. Halteres short, the club large, pyriform, grey, with exceedingly minute brown scales. Abdomen black with a yellowish tint, densely covered with moderately long hairs; ovipositor long, with two small yellow lamellæ. Legs moderately long, slender, yellowish-grey; femora and tibiæ with brownish hairs. Wing densely covered with longish somewhat interwoven pubescence, iridescent, with roseous and golden reflections. Veins pale brownish. First longitudinal vein wide of the costa, joining the margin about half way to the tip; cross-vein very prominent, rather oblique; second longitudinal vein not sinuated before the cross-vein, reaching the margin immediately beyond the apex of the wing; third longitudinal vein almost straight, slightly bent just before joining the posterior margin; fourth longitudinal vein turning towards the margin in an obtuse rounded angle. (Description drawn from dried specimen).

Hab.—Elizabeth Bay (Masters and Skuse). January.

Genus 4. SPANIOCERA, Winnertz.

Spaniocera, Winnertz, L.E., 1853, pp. 190 and 306; Rondani, II^{da} Mem. Parma, 1840, &c.; *Brachyneura*, Stirp. Cec., 1860, pp. 287 and 292; O-Sacken, Mon. Dipt. N. America, 1862, p. 175; Schiner, F.A. II., 1864, p. 406.

Antennæ filiform, 2- + 11-jointed, the joints long, cylindrical, with a short pubescence, and without verticils. Wings moderately large; considerably rounded, with a wedge-shaped base; clothed with scaly hairs. Three longitudinal veins, all simple. The first longitudinal vein close to the costa; second longitudinal vein some distance from it, arcuating anteriorly, and reaching the margin considerably before the apex of the wing (Pl. III., fig. 17).

Obs.—I have as yet failed to detect any Australian species referable to this; and the type, *S. squamigera*, is I believe the only known species.

Genus 5. LASIOPTERA, Meigen.

Lasioptera, Meigen, S.B. I., 1818, p. 88, pl. III.; *Lasiopteryx*, Stephens; Macquart, S. à B.I., 1834, p. 162; Rondani, II^{da} Mem. Parma, 1840, &c.; H. Loew, D.B. IV., 1850, p. 21; Zetterstedt, D.Sc., IX., 1850, p. 3699; Winnertz, L.E., 1853, p. 191; Walker, I.B. III., 1856, p. 132; O.-Sacken, Mon. Dipt. N. America, 1862, p. 175; Schiner, F.A. II., 1864, p. 406.

Antennæ from 2-+14- to 2-+32-jointed; joints sub-globose, sessile, with short verticillate hairs. Wings rather short and broad; with or without a white spot on the middle of the anterior border. Three longitudinal veins, the first and second running so near the costa as to be hardly discernible; no cross-vein (Pl. III., fig. 18).

A. *Wings with a white spot on the middle of the anterior border.*

79. LASIOPTERA MASTERSI, sp.n.

♀.—Length of antennæ.....	0·025 inch	...	0·62 millimètre.
Expanse of wings.....	0·110 × 0·040	...	2·79 × 1·01
Size of body.....	0·090 × 0·030	...	2·27 × 0·76

Antennæ black, 2-+15-jointed, joints about as long as broad, sessile, with a short hoary pubescence; two basal joints brownish. Head black with a golden pubescence, front hoary. Thorax shining black, with two longitudinal rows of erect golden hairs, sparingly haired from the collare down to the origin of the wings, bare anteriorly. Halteres yellowish. Abdomen pale reddish-brown, each segment with a row of black scales, the hinder segments also with rows of white scales. Coxæ brown, hoary. Femora black on the upper side and tip, laterally and the outermost extremity of the tip whitish. Tibiæ brown inclined to black. Tarsi whitish. Wings with a bluish reflection, hairs on the surface and fringe grey. Costal border covered with black

scales, with a white spot at the junction with the second longitudinal vein. First longitudinal vein so close to the costa as to be hardly discernible; second longitudinal distinctly visible for the whole of its length. (Description drawn from dried specimen).

Hub.—Woronora (Masters and Skuse). October.

80. LASIOPTERA VASTATRIX, sp.n.

♂.—Length of antennæ	0.025 inch	...	0.63 millimètre.
Expanse of wings	0.090 × 0.035	...	2.27 × 0.88
Size of body	0.090 × 0.020	...	2.27 × 0.50
♀.—Length of antennæ	0.023 inch	...	0.57 millimètre.
Expanse of wings	0.090 × 0.035	...	2.27 × 0.88
Size of body	0.095 × 0.030	...	2.39 × 0.76

Antennæ black or dark brown, in the ♂ 2- + 15-jointed, in the ♀ 2- + 14-jointed; joints sessile, sub-globular, rather longer than broad, smaller towards the end of the flagellum, with short pale pubescence. Palpi yellowish-brown. Thorax deep brown covered with golden-yellow scales and pubescence; two rows of erect hairs extending from the collare to the scutellum, short at the collare, increasing in length towards the hinder margin; some long hairs before the base of the wings (below this tuft and immediately in front of the origin of the wings is a small patch of white scales); pleuræ brown. Halteres pale brown at the base, white scales on the stalk, the club brown, darker in the ♀ than the ♂, with some scattered dark brown or black scales. Abdomen covered superiorly on each segment with deep brown scales, bordered behind with a band of white in the ♂, and yellowish in the ♀; this band in the ♂ is almost as broad as that of the brown scales; pale brown between the segments; pale brown underneath, covered with white scales; forceps in the ♂ densely covered with white scales and long hairs; ♀ ovipositor pale brownish, appearing somewhat blunt. Legs densely clothed with scales, appearing deep brown with pale reflections when viewed at a certain obliquity. Wings yellowish-brown at the root, hyaline, with a weak cupreous reflection;

deeply ciliated on the posterior border. Costal deep brown, thickly scaled, and having a yellowish-white spot at the junction with the second longitudinal vein. First and second longitudinal veins pale brown, the former short and close to the costa; third longitudinal very pale. (Description drawn from fresh specimens).

Larva.

Size of body... 0.120×0.035 inch ... 3.04×0.88 millimètres.
 Breast-bone.... 0.012 ... 0.30

Oblong, bright saffron-yellow, glabrous, minutely granulate. Head distinct, retractile, with two very short pale yellowish antennæ near the tip. Breast-bone deep reddish-brown, visible for the whole of its length, of almost uniform width, exerted anteriorly for less than one-sixth of its length, with four triangular projections, the middle pair in advance of the lateral ones; posterior portion somewhat diaphanous. Stigmata very indistinct.

Inhabiting grass-stems, generally that portion underneath the spathe. The deformation caused is a scarcely perceptible swelling, extending from an inch to an inch and a-half in length, and containing from ten to a dozen larvæ, lying somewhat obliquely, enveloped in delicate white filmy cocoons. These larvæ have as yet only been found in a species of grass in the Parkes district, where they prove very destructive to the pasture.

Pupa.

Size of body... 0.080×0.040 inch ... 2.02×1.01 millimètres.

Oblong, pale, ochraceous-brown, obvolute; head bifid in front; thorax somewhat gibbose, nitidous, paler than the abdomen; abdomen minutely granulate, without spines.

Imagines began to emerge on the 5th December.

B. Wings without a white spot on the anterior border.

81. LASIOPTERA AURATA, sp.n.

♂.—Length of antennæ..... — inch ... — millimètres.
 Expanse of wings..... 0.160×0.060 ... 4.06×1.54
 Size of body..... 0.130×0.035 ... 3.29×0.88

Basal joints of antennæ (the remainder lost) golden-yellow. Head covered with golden-yellow scales. Palpi yellowish-brown. Thorax and abdomen pale brown, almost covered with golden-yellow scales, no bands. Pleuræ yellowish-brown. Halteres yellowish. Coxæ and femora golden-yellow. Tibiæ golden-yellow, black along the upper side. Tarsi black, except the two last joints, which are hoary when viewed in a certain oblique direction. Wings with a bluish reflection, hairs on the surface and fringe grey. Costal border covered with golden-yellow scales and hair to the end of the second longitudinal vein, except a longitudinal band of black scales near the base. First and second longitudinal veins close to the costa, yellowish, sparingly sprinkled with golden-yellow scales; base of the third longitudinal vein sparingly covered with black scales, branches of the fork indistinct. (Description drawn from dried specimen).

Hab.—Middle Harbour (Skuse). September.

82. LASIOPTERA NODOSÆ, sp.n.

♀.—Length of antennæ.....	0.030 inch	...	0.76 millimètre.
Expanse of wings....	0.080 × 0.040	...	2.02 × 1.01
Size of body.....	0.060 × 0.030	...	1.54 × 0.76

Antennæ sordid brown, 2- + 32-jointed; joints as long as broad, sessile, with a short greyish pubescence. Head black, with white scales and greyish hairs on the vertex. Palpi sordid yellow. Thorax deep brown, sprinkled with a very fine silvery pubescence; white scales from the collare to the base of the wings, also forming a rather prominent longitudinal band along the middle from the collare to the scutellum, and scattered along the hinder margin of the mesothorax. Halteres whitish, the knob tipped with brown, a number of very long silvery hairs in their vicinity. Abdomen black, each segment with a marginal fringe of short silvery hairs. Coxæ pale, with silvery pubescence. Femora whitish, brown towards the tip. Tibiæ brown, pale along one side and at the tip. Tarsi brown with a pale reflection. Wings beautifully

iridescent, and covered with fine almost straight hairs. Costal margin black, thickly covered with scales. First longitudinal vein hardly discernible when the scales are removed; second longitudinal vein also black and scaly, close to the costa; third longitudinal very indistinct. (Description drawn from dried specimen).

Hab.—Homebush. Bred from deformed buds of *Melaleuca nodosa*, obtained in November (Masters).

83. LASIOPTERA MISCELLA, sp.n.

♀.—Length of antennæ	0.030 inch	...	0.76 millimètre.
Expanse of wings.....	0.070 × 0.030	...	1.77 × 0.76
Size of body.....	0.070 × 0.020	...	1.77 × 0.50

Antennæ black, 2- + 32-jointed; joints depressed, decreasing in size towards the tip, with a dense pale pubescence; basal joints brown. Palpi reddish-brown, with white scales and hairs. Head black, white scales on the vertex. Thorax black, nitidous, with a few scales and hairs; pleuræ black with a tinge of brown; scutellum prominent, shining black. Halteres pale reddish-brown, the apical half of the club yellowish. Abdomen black superiorly, with white scales, and a row of pale hairs along the posterior border of each segment; reddish-brown underneath; ovipositor yellowish-brown. Legs moderately long, slender. Coxæ umber brown. Femora umber brown, with white scales and hairs. Tibiæ and tarsi umber brown, almost black, the former white at the extreme tip. Wings moderately haired, hyaline, with very little reflection. Costal and two first longitudinal veins brown, the first thickly covered with scales and hair; third longitudinal vein very pale and indistinct. (Description drawn from dried specimen).

Hab.—Elizabeth Bay (Masters). Beginning of January.

84. LASIOPTERA CORUSCA, sp.n.

♂.—Length of antennæ.....	0.020 inch	...	0.50 millimètre.
Expanse of wings.....	0.060 × 0.025	...	1.54 × 0.62
Size of body.....	0.040 × 0.010	...	1.01 × 0.25

Antennæ half as long as the body, 2-+16-jointed; flagellar joints deep brown or black, rather longer than broad, sessile, with a yellowish pubescence; basal joints pale ferruginous. Head deep brown or black with a golden pubescence on the vertex. Palpi yellowish-brown, with a yellowish pubescence. Thorax deep reddish-brown, with golden scales and hairs; humeri, scutellum, and pleuræ ferruginous-ochraceous; scutellum with golden scales and hairs. Halteres ferruginous on the stalk, the club elongate, almost pyriform, with a golden pubescence. Abdomen ferruginous, the dorsal segments with deep brown scales, posteriorly bordered with golden scales and long hairs; forceps light umber with a pale pubescence. Legs moderately long, slender. Coxæ, femora, and tibiæ ferruginous-ochraceous, with golden scales and pubescence. Tarsi covered with deep brown or black scales. Wings yellowish-brown at the roots, hyaline, with bright margaritaceous reflections. Costal and two first longitudinal veins yellowish-brown; the costal with deep brown scales and a short pubescence; third longitudinal vein very pale, but distinctly discernible, gradually arcuating into the posterior border; anterior branch nearly straight, almost as long as the whole of the posterior vein. (Description drawn from dried specimen).

Hab. — Gosford (Skuse). February.

Obs.—Six specimens taken on the wing in a shady situation, all proved to be males.

85. LASIOPTERA HELVIPES, sp.n.

♂.—Length of antennæ.....	0·017 inch	..	0·42 millimètre.
Expanse of wings.....	0·060 × 0·030	...	1·54 × 0·76
Size of body.....	0·050 × 0·020	...	1·27 × 0·50

Antennæ pale brownish, 2-+17-jointed, sessile, with greyish pubescence. Head black or dark brown, with a pale pubescence on the vertex. Palpi yellowish. Thorax pale brown, with yellowish scales and hairs, an indistinct longitudinal band of scales down the middle. Halteres pale yellow. Abdomen covered with

black scales, except a pair of white spots on each of the first five segments. Legs sordid yellow. Wings with splendid reflections, hairs on the surface long, almost straight. Costal border deep brown, scaly. First longitudinal vein indiscernible; second longitudinal vein sordid brown, scaly; third longitudinal very indistinct. (Description drawn from dried specimen).

Hab.—Sydney (Masters).

Sub-genus. CLINORHYNCHA, Loew.

Clinorhyncha, H. Loew, D.B. IV., 1850, p. 21; Rondani, II^{da} Mem. Parma, 1840, &c.; Winnertz, L.E., 1853, p. 192; O.-Sacken, Mon. Dipt. N. America, 1862, p. 175; Schiner, F. A. II., 1864, p. 409.

Characters the same as in *Lasioptera* with the difference that the mouth is prolonged in a rostrum.

Obs.—I cannot yet record any Australian species referable to this sub-genus. Up to the present I think all the known species have been described from Europe, and they only number three or four.

Sub-family II. LESTREMINA.

Wings with at least four longitudinal veins, or at most five, sometimes with a rudimentary vein behind the fifth; the additional (or third) vein is situated between the two longitudinal veins corresponding to the second and third of the first sub-family, and is generally furcate; ocelli nearly always present; first tarsal joint not shortened.

I. OCELLI EXTANT.

A. Wings with four longitudinal veins; the third not furcate; the fourth furcate, representing the fourth and fifth longitudinal veins of other genera, coalescent for the first half of their course.

Genus I. CAMPYLOMYZA, Meigen.

Campylomyza, Meigen, S.B. I., 1818, p. 101; Macquart, S. à B. I., 1834, p. 150, pl. IV.; *Campylomyza* and *Neurolyga*, Rondani;

Campylomyia, Zetterstedt, D.Sc., IX., 1850, p. 3669; *Campylomyza*, Walker, I.B. III., 1856, p. 61; O.-Sacken, Mon. Dipt. N. America, I., 1862, p. 178; Schiner, F.A. II., 1864, p. 411; Winnertz, V. z.-b. G. Wien, 1870, p. 9.

Antennæ 2-+6- to 2-+23-jointed, moniliform, verticillate; joints ovate, lentiform or cylindrical, with long pedicels in the ♂, and short ones in the ♀, or sessile in both sexes. Wings large, considerably rounded at the apex; in some cases the base of the wings is cuneiform, in others the posterior angle is prominently rounded; hairs often scaly; long cross-vein* (Pl. III., figs. 19 and 20).

a. *Wings cuneiformly narrowed at the base.*

86. CAMPYLOMYZA PERPALLIDA, sp.n.

♀.—Length of antennæ..... 0.017 inch ... 0.42 millimètre.

Expanse of wings..... 0.035 × 0.017 ... 0.88 × 0.42

Size of body..... 0.040 × 0.008 ... 1.01 × 0.20

Antennæ pale brown, 2-+9-jointed; basal joints very large, paler than those of the flagellum; joints globose, verticillate-pilose, gradually becoming smaller towards the end; pedicels longer than the joints. Front and palpi yellowish-brown, densely covered with a somewhat scaly pubescence. Thorax pale brown, with yellowish hairs; pleuræ yellowish; scutellum rather paler than the mesothorax, almost lunate, pubescent. Halteres pale yellow, sprinkled with deep brown or black scales, the club elongate. Abdomen large, sparsely sprinkled with deep brown or black scales and scaly hairs; ovipositor apparently short, very pale yellowish, the lamellæ elongate, minutely ciliate. Legs short, rather slender, yellowish, with a pale pubescence; femora strongly developed; tarsal joints more robust than the tibiæ, of uniform thickness. Wings pellucid, with a very pale bluish tint, densely covered with yellowish scaly hairs, moderately ciliated on all borders with very fine hairs, and having a brassy reflection. First longitudinal reaching the anterior border about half-way to

* Winnertz, in giving the characteristics of this genus, says, "Schwinger unbedeckt," but although I have examined a large number of specimens, my observations persistently prove the contrary.

the apex of the wing; second longitudinal vein meeting the border a short distance beyond the apex of the wing, its basal portion more than five times the length of the transverse vein; transverse vein moderately oblique; third longitudinal vein very indistinct, issuing from the basal portion of the second longitudinal a little beyond the middle, running almost straight to the margin; fourth longitudinal vein rather near the posterior border, little arcuated, the anterior branch very indistinct. (Description drawn from dried specimen).

Hab.—Sydney (Skuse). January.

87. *CAMPYLOMYZA ÆRATIPENNIS*, sp.n.

♀.—Length of antennæ.....	0·015 inch	...	0·38 millimètre.
Expanse of wings.....	0·040 × 0·020	...	1·01 × 0·50
Size of body.....	0·040 × 0·08	...	1·01 × 0·20

Antennæ pale brown, 2- + 9-jointed; joints globose, verticillate-pilose, separated by pedicels which are as long as the joints. Thorax deep brown, with a golden yellow pubescence. Poisers brown, pale yellowish at the base, pubescent. Abdomen yellowish-brown, paler between the segments, last two or three joints considerably paler than the preceding ones. Legs short, somewhat robust, brownish-yellow; femora and tibiæ strong; first tarsal joint slender. Wings pellucid, with a pale bluish tint, densely clothed with scaly hairs, and having a bright brassy reflection; the apex not quite so rounded as in *perpallida*. Costal vein strongly developed. First longitudinal vein reaching the anterior margin about half way to the apex of the wing; second longitudinal meeting the costal immediately beyond the apex; its basal portion about five times as long as the cross-vein; cross-vein moderately oblique; third longitudinal vein very pale, issuing from the basal portion of the second longitudinal at about two-thirds of its length, and disappearing at about two-thirds of the distance to the margin; fourth longitudinal vein indistinct, both branches almost invisible before joining the posterior margin and very moderately arcuated. (Description drawn from dried specimen).

Hab.—Elizabeth Bay (Masters). December.

88. *CAMPYLOMYZA PERSIMILIS*, sp.n.

♀.—Length of antennæ.....	0·015 inch	...	0·38 millimètre.
Expanse of wings.....	0·030 × 0·012	...	0·76 × 0·30
Size of body.....	0·020 × 0·006	...	0·50 × 0·15

Antennæ pale brown, 2- + 9-jointed; joints sub-globose, sparsely verticillate-pilose, terminal joints considerably smaller than the preceding ones; pedicels not as long as the joints. Hypostoma and front sordid yellowish-brown. Palpi yellow. Thorax brown, minutely pubescent; pleuræ sordid yellowish-brown. Halteres long and moderately robust, club elongate, with blackish pubescence, stalk yellowish. Abdomen uniformly sordid yellowish-brown, densely clothed with scales and hairs, paler underneath; ovipositor and lamellæ pale yellow. Legs sordid ochraceous, rather densely pubescent; femora somewhat more robust than the tibiæ and tarsi; first tarsal joint twice the length of the second, the latter as long as the following two, the three last about the same length; all slender. Wings pale yellowish at the base; pellucid, with a pale bluish tint, rather thickly covered with scaly hairs, particularly towards the tip; moderately deeply ciliated, with a very pale yellow reflection. Veins yellowish-brown. First longitudinal vein reaching the costal about half-way to the apex of the wing; second longitudinal vein somewhat sinuose before the cross-vein, reaching the border immediately below the apex; cross-vein distinct; third longitudinal vein indistinct, joining the border a short distance below the second longitudinal; fourth longitudinal vein indistinct, rather close to the margin, not very arcuated; anterior branch almost as long as the whole of the posterior vein, very indistinct. (Description drawn from fresh specimen).

Hab.—Sydney (Skuse). Beginning of December.

89. *CAMPYLOMYZA CROCEA*, sp.n.

♀.—Length of antennæ.....	0·015 inch	...	0·38 millimètre.
Expanse of wings.....	0·035 × 0·017	...	0·88 × 0·42
Size of body.....	0·025 × 0·008	...	0·62 × 0·20

Antennæ pale brown, 2- + 9-jointed, joints sub-globose, verticillate-pilose, pedicels rather longer than the joints. Front and palpi yellowish-brown. Thorax light red-brown, nitidous, with a yellow pubescence; pleuræ light red-brown; scutellum almost triangular, the same colour as the mesothorax, with yellow hairs. Halteres moderately long, thick, the club elongate, rather thicker than the stalk, with a deep brown or black scaly pubescence. Abdomen ferruginous-ochraceous, darker at the extremity, somewhat thickly clothed with laterally directed deep brown or black scaly hairs, the last two or three segments with a longitudinally directed pubescence; ovipositor apparently short, pale ochraceous, with narrow elongate lamellæ. Legs short, rather robust, ochraceous, with the articulations and tarsal joints tinged with ferruginous; densely pubescent. Femora and tibiæ rather robust. Tarsal joints of almost equal thickness, the base of the first one somewhat narrowed. Wings pellucid, with a pale bluish tint, densely covered with scaly hairs, well ciliated in the posterior border with delicate hairs, and exhibiting a pale brassy reflection when viewed at a certain obliquity. Costal densely covered with a short dense pubescence. First longitudinal vein indistinct at its tip, reaching the costa about half way to the apex of the wing; cross-vein not very distinct; second longitudinal vein remarkably sinuose before the cross-vein, joining the margin beyond the apex of the wing; fourth longitudinal vein little arcuated, invisible before reaching the posterior border, its anterior branch almost indistinguishable. (Description drawn from dried specimen).

Hab.—Elizabeth Bay (Skuse).

90. *CAMPYLOMYZA SUBTILIS*, sp.n.

♂.—Length of antennæ.....	0.030 inch	...	0.76 millimètre.
Expanse of wings.....	0.040 × 0.018	...	1.01 × 0.45
Size of body.....	0.030 × 0.006	...	0.76 × 0.15

Antennæ yellow, tinged with brown, 2- + 13-jointed, the last joint very small and rudimentary; basal joints about the same size as the flagellar joints; joints small near the base of the

flagellum, almost globose, somewhat flattened, one half shorter than the pedicels, towards the tip very much flattened, the pedicels being then three times their length; long and dense verticillate hairs. Palpi densely covered with a pale yellowish pubescence. Front pale brown. Thorax sordid yellowish-brown, with moderately long pale hairs; pleuræ yellowish; scutellum narrow, lunate, with a few hairs. Halteres rather short, the club elongate, covered with a brown pubescence, one half thicker and rather longer than the stem, the stem yellowish, pubescent. Abdomen almost cylindrical, densely pubescent, sordid yellowish-brown for the first four segments, darkening into dusky brown on the terminal segment. Legs short and slender, sordid ochraceous, densely pubescent. Femora rather thicker than the tibiæ, but not very strongly developed. Tarsal joints of equal thickness, except that the metatarsal joint is somewhat narrowed at the base. Wings pellucid, with a very pale bluish tint, very densely covered with scaly hairs, densely ciliated, and having an indifferent brassy reflection. First longitudinal vein joining the costa half way to the apex of the wing; second longitudinal reaching the margin a little beyond the apex of the wing, its basal portion somewhat sinuose, six times as long as the transverse vein; transverse vein rather pale, joining the first longitudinal at three-fourths of its length from the base; third longitudinal vein most indistinct; fourth longitudinal very pale, very little arcuated, invisible just before the posterior border; anterior branch only just distinguishable, almost as long as the whole posterior vein. (Description drawn from dried specimen).

Hab.—Elizabeth Bay (Masters and Skuse).

91. CAMPYLOMYZA VICINA sp.n.

♂.—Length of antennæ.....	0·020 inch	...	0·50 millimètre.
Expanse of wings.....	0·040 × 0·018	...	1·01 × 0·45
Size of body.....	0·030 × 0·006	...	0·76 × 0·15

Antennæ pale brown, 2-+13-jointed, the last joint very small and rudimentary; basal joints thicker than but not so wide as

those of the flagellum, yellowish; flagellar joints large, considerably flattened, much darker than the pedicels, with long dense brown verticillate hairs, the two joints immediately preceding the terminal rudimentary joint very close together, and not so flattened as the others. Palpi rather robust, densely pubescent, sordid ochraceous. Thorax dusky yellowish-brown, with two somewhat dense rows of pale hairs from the collare to the scutellum; pleuræ yellowish-brown; scutellum prominent, narrow, scarcely lunate, yellowish-brown. Halteres moderately long, the stem rather thick, yellowish, with a pyriform club, densely covered with a brownish pubescence. Abdomen dusky yellowish-brown, the dorsal segments densely scaled, terminal segment rather thickly haired. Legs short and slender, pale ochraceous, the coxæ and tarsi tinged with ferruginous. Second tarsal joint nearly as long as the first; the remaining joints somewhat thicker than the two first. Wings pellucid, with a very pale bluish tint, densely covered with scaly hairs, particularly on the apical portion; brassy reflection. First longitudinal vein invisible just before reaching the costa; second longitudinal vein not sinuose before the cross-vein, reaching the margin immediately beyond the apex of the wing, its basal portion six times the length of the cross-vein; cross-vein not very oblique, pale; third longitudinal vein most indistinct; fourth longitudinal indistinct, invisible some distance before the posterior border; anterior branch scarcely distinguishable, very little arcuated. (Description drawn from dried specimen).

Hab.—Elizabeth Bay (Masters and Skuse).

92. *CAMPYLOMYZA IMPEXA*, sp.n.

♂.—Length of antennæ... . 0·020 inch ... 0·50 millimètre.
 Expanse of wings..... 0·035 × 0·017 ... 0·88 × 0·42
 Size of body..... 0·020 × 0·005 ... 0·50 × 0·13

Antennæ ochraceous-brown, 2-+12-jointed; basal joints pale reddish-brown, first basal joint much larger than the second,

pilose; flagellar joints considerably flattened; the terminal joint with a small projection; verticils long and dense; pedicels one half longer than the joints. Palpi ochraceous-brown. Thorax deep brown, with a sparse golden-yellow pubescence; pleuræ pale reddish-brown. Halteres long and rather robust, club elongate; stalk pale, club covered with a black pubescence. Abdomen deep brown densely covered with scales and hairs. Legs ochraceous-brown, the femora somewhat ferruginous, very densely pubescent; femora and tibiæ robust; first tarsal joint slender; second not so long as the first; the rest of nearly equal length. Wings somewhat ferruginous at the base, pellucid, with a very pale brownish tint, densely ciliated and covered with a scaly pubescence; rich golden and roseous reflections. First longitudinal vein reaching the costal about half way to the apex of the wing; second longitudinal vein meeting the border a little beyond the apex; cross-vein very distinct, not very oblique; third longitudinal vein straight, rather indistinct, reaching the border a little below the second longitudinal vein; fourth longitudinal gradually arcuating into the posterior margin, anterior branch very indistinct. (Description drawn from dried specimen).

Hab.—Elizabeth Bay (Masters and Skuse). September.

93. *CAMPYLOMYZA PELLAX*, sp.n.

♂.—Length of antennæ.....	0.015 inch	...	0.38 millimètre.
Expanse of wings.....	0.025 × 0.010	...	0.62 × 0.25
Size of body.....	0.020 × 0.005	...	0.50 × 0.12

Antennæ brown, 2- + 11-jointed; basal joints paler than those of the flagellum; flagellar joints almost twice as wide as long, particularly those near the base, almost as long as the pedicels, and having long brownish verticillate hairs; terminal joint rather larger than the one immediately before it, and considerably rounded. Palpi slender, sordid yellowish, deeply pubescent. Thorax black or nearly so, nitidous, with somewhat long pale hairs; pleuræ dusky brown; scutellum narrow, lunate, deep umber-brown. Halteres dusky yellow, club pyriform, pubescent.

Abdomen deep brown, almost black, scaled, with a very minute pubescence on the terminal segment. Legs short and slender, of a uniform dusky yellow colour, with only the tarsi densely pubescent, and all the joints of almost uniform thickness. First tarsal joint twice the length of the second. Wings pellucid, with a very faint bluish tint, densely covered with scaly hairs with a slight intermixture of fine simple hairs, densely ciliated, and having a bright almost silvery reflection. First longitudinal not very distinct, invisible shortly after leaving the cross-vein; second longitudinal vein somewhat crooked before the cross-vein, but not sinuose, reaching the wing-margin just beyond the apex, its basal portion about six times the length of the cross-vein; cross-vein pale, indistinct anteriorly; third longitudinal not distinguishable; fourth longitudinal vein very distinct until just before joining the posterior border, when it becomes most indistinct; anterior branch invisible. (Description drawn from dried specimen).

Hab.—Elizabeth Bay (Masters and Skuse).

94. *CAMPYLOMYZA SYDNEYENSIS*, Schiner.

Campylomyza Sydneyensis, Schiner, *Diptera der Novara-Expedition*, Zool. Theil. Bd. II., p. 7.

“Shining black, the legs very dark pitchy brown. Antennæ moniliform, 2-+12-jointed, the flagellar joints pressed to one another, almost of equal length, only the last double the length of the preceding ones, and considerably narrower than the latter; the hairs very delicate. Palpi blackish-brown, the second joint very long and robust, standing off angularly from the first, the two last small. The legs, and particularly the thighs, strong; the last joint of the tarsi slender and much longer than the preceding. Wings almost hyaline, microscopically haired; the veins normal, but the cross-vein is not very distinct, and there appears between the discoidal and the postical, towards the margin of the wing, a piece of a vein, which must be regarded as a rudiment of the lower branch of the discoidal. The terminal lamellæ of the ♀ brown.”

$\frac{3}{4}$ '''—Sydney.

Obs.—Not having seen this species, I am unable to definitely fix its true position amongst the rest of the genus, the above description even giving no clue as to which division the insect belongs, but I have placed it here provisionally.

b. *Wings rounded at the base.*

95. *CAMPYLOMYZA AMPLIPENNIS*, sp.n.

♂.—Length of antennæ.....	0·025 inch	...	0·62 millimètre.
Expanse of wings.....	0·045 × 0·020	...	1·13 × 0·50
Size of body.....	0·035 × 0·008	...	0·88 × 0·20

Antennæ sordid yellowish, 2-+12-jointed; basal joints rather smaller than the first flagellar joint, the latter appearing almost pyriform, remaining joints sub-globose, rather wider than long on the basal half of the flagellum, the rest somewhat longer than broad; verticillate hairs sparse and unequal; pedicels about half as long as the joints. Palpi slender, sordid yellowish. Thorax black, almost levigate, with a short, pale, scattered pubescence; pleuræ sordid yellowish; scutellum very narrow, hardly lunate, sordid yellowish. Halteres sordid yellowish, with minute black scales and hairs, club pyriform. Abdomen dusky brown, with a dull ochraceous tinge on the first two or three and the last two dorsal segments, moderately clothed with a golden-yellow pubescence. Legs short and rather slender, of a uniform dusky ochraceous colour, densely pubescent. Femora and tibiæ somewhat more robust than the tarsi. Metatarsal joint longer than the two following combined. Wings pellucid, with a delicate bluish tint, moderately and uniformly covered with very fine yellowish hairs, and sparsely ciliated with longer hairs of the same description; no scales or scaly hairs on the wings. First longitudinal vein rather wide of the costa, paler at its tip; second longitudinal vein at its root very near the first longitudinal, then considerably diverging, but bent a little anteriorly just before the cross-vein, and afterward resuming its posterior inclination, joining the margin at the apex of the wing, its basal portion rather more than three times the length of the cross-vein; cross-vein distinct, not very oblique; third longitudinal vein pale, very

much arcuated; anterior branch indistinct, very little bent. (Description drawn from dried specimen).

Hab.—Middle Harbour (Skuse).

B. Wings with five longitudinal veins; the third furcate; the fourth and fifth separate from their base.

Genus 2. TRITOTYGA, Loew.

Tritotyga, H. Loew in O.-Sacken, Mon. Dipt. N. America, 1862, pp. 178-179.

Antennæ as in the last genus, the number of joints uncertain. Wings rounded at the base and apex. Second longitudinal vein running rather close to the costa and joining much before the apex of the wing; the upper branch of the third longitudinal vein forming a double curve, almost in the shape of an S (Pl. III., fig. 21).

Obs.—This genus was founded by Prof. Loew upon an imperfect specimen of a North American species, and no further example has to my knowledge since been observed in any country. The whole structure of the body of this insect, according to Prof. Loew, shows the nearest relation to *Campylomyza*.

Genus 3. CATOCHA, Haliday.

Catocha, Haliday, Ent. Mag. I., 1833, p. 156; Macquart, S. à B. II., 1835, p. 654; Rondani, 11^{da} Mem. Parma, 1840, &c.; Winertz, Stett. E.Z. VII, 1846, p. 20 (*Macrostyla*); V. z.-b. G. Wien, 1870, p. 27; Walker, I.B. III. 1056, p. 59; O.-Sacken, Mon. Dipt. N. America, 1862, p. 177; Schiner, F.A. II., 1864, p. 412.

Antennæ moniliform, verticillate; in the ♂ 2-+14-, and in the ♀ 2-+8-jointed, the flagellar joint almost ovate; pedicels longer in the ♂ than the ♀; the first joint sessile. Wings large, considerably rounded at the apex, with cuneiform base. First longitudinal vein long, arcuating into the costa somewhat abruptly; second longitudinal vein reaching the margin about the apex of the wing; the upper branch of the third longitudinal vein forming a smooth curve; small cross-vein at or before the middle of the first longitudinal vein (Pl. III., fig. 22).

Obs.—Only a few European species known.

Genus 4. LESTREMIA, Macquart.

Lestremia, Macquart, Dipt. du Nord de la France I., 1826, p. 173; Meigen, S.B. VI., 1830, p. 308; Rondani, 11^{da} Mem. Parma, 1840; (*Lestremia*, *Mimosciara*, and *Yposataea*) Prodrömus I., 1856, p. 198; Zetterstedt, D.Sc. X., 1851, p. 3767; Walker, I.B., III., 1856, p. 57; O.-Sacken, Mon. Dipt. N. America, 1862, p. 178; Schiner, F.A. II., 1864, p. 413; Winnertz, V. z.-b. G. Wien, 1870, p. 30.

Antennæ moniliform, verticillate; in the ♂ 2-+14-, in the ♀ 2-+9- to 2-+10-jointed; the joints in the ♂ almost ovate, pedicelled, in the ♀ more cylindrical, with short pedicels. Wings large, moderately broad, with rounded apex, and prominent posterior angle. First longitudinal vein very short; second longitudinal vein short, running rather close to the costa, joining the border much before the apex of the wing; third longitudinal vein with a very long fork; cross-vein small, beyond the middle of the first longitudinal vein (Pl. III., figs. 23 and 24).

Obs.—A few European and American species only are known.

II. OCELLI WANTING.

Genus 5. CECIDOGONA, Loew.

Cecidogona, H. Loew, Stett. E.Z. 1844, p. 324; Walker, I.B. III., 1856, p. 58; O.-Sacken, Mon. Dipt. N. America, I., 1862, p. 178; Schiner, F.A. II., 1864, p. 413 (*Lestremia*); Winnertz, V. z.-b. G. Wien, 1870, p. 35 (*Lestremia*).

Antennæ in the ♀ 2-+9-jointed; joints verticillate, with very short pedicels. Wings tolerably broad, with rounded apex and posterior angle. First longitudinal vein very short; second longitudinal vein reaching the margin close to the apex of the wing; branches of the third longitudinal vein long, almost parallel to one another; cross-vein very oblique.

Obs.—As far as I am aware, Loew's type of the genus, *Cecidogona carnea*, described from Europe, is the only known species.

EXPLANATION OF PLATES.

PLATE II.

- Fig. 1. Venation of wings in the genus *Heteropeza*.
 2. " " " *Miastor*.
 3-16 " " " *Cecidomyia*.
 3. " " sub-genus *Gonioclema*.
 4. } " " " *Cecidomyia*.
 5. }
 6. " " " *Diplosis* (A).
 7. " " " " (B).
 8. " " " *Asphondylia*.
 9. " " " *Hormomyia*.
 10. " " " *Necrophlebia*.
 11. " " " *Chastomera*.
 12. " " " *Colpodia*.
 13. " " " *Epidosis*.
 14. " " *Epidosis gibberosa*.

PLATE III.

15. Venation of wings in the sub-genus *Asynapta* (a).
 16. " " " " (b).
 17. " " genus *Spaniocera*.
 18. " " " *Lasioptera*.
 19. " " " *Campylomyza* (a).
 20. " " " " (b).
 21. " " " *Tritozya*.
 22. " " " *Catocha*.
 23. } " " " *Lestremia*.
 24. }
 25. Diagram of an ideal typical wing illustrating the vein-system in the *Diptera*.

NOTES ON THE NESTS AND EGGS OF CERTAIN AUSTRALIAN BIRDS.

BY A. J. NORTH, F.L.S.

EOPSALTRIA CAPITO, *Gould.*

The localities which this bird frequents are the rich brushes that clothe the sides of the rivers on the eastern coast of Australia, extending from Rockingham Bay in the north, to the Clarence River in the south. A nest of this species now before me taken from the low fork of a tree near Ballina on the Richmond River, is a deep cup-shaped structure composed of portions of the dried leaves of the "lawyer-vine" (*Calamus australis*), held together with a few wiry grass stems, the whole exterior being covered with fine mosses, and ornamented in a few places with large pieces of lichens. Exterior diameter two and three quarters of an inch, by two inches and a-half in depth; interior diameter one and seven-eighths of an inch, by one and five-eighths of an inch in depth. Eggs two in number for a sitting, oval in form, slightly tapering at one end, of a very faint dull greenish-white covered with indistinct markings of yellowish and reddish-brown which at the larger end become more boldly defined, where, intermingled with superimposed blotches of wood-brown, they form an irregularly shaped zone. Length 0.82×0.6 inch. The eggs of this bird are entirely devoid of the rich apple-green ground colour of the southern representative, *E. australis*. (*From Mr. R. D. Fitzgerald's Coll.*)

STICTOPTERA ANNULOSA, *Gould.*

This pretty little Finch is found frequenting the northern and north-western portions of the Australian Continent, where it takes

the place of its near ally, *S. bichenovii*, of the eastern coast. Both Mr. E. J. Cairn and the late Mr. T. H. Boyer-Bower obtained a number of specimens of this bird in 1886, at Derby, North-western Australia. For the opportunity of describing the eggs, I am indebted to the Hon. William Macleay, who has lately received them from his collector, Mr. W. W. Froggatt; they were taken near the head of the Leonard River on October 2nd, 1887. The nest was a flask-shaped structure of dried grasses, similar to those of other members of the family, and was built in a low bush. In this instance the nest contained three fresh eggs, but five is the usual complement; in colour they are white, of a uniform size, each of them giving exactly the same measurement, viz. :—0·55 inch in length by 0·44 inch in width. These are among the smallest of our Australian birds' eggs. (*From the Macleayan Museum Coll.*).

ÆLURÆDUS MACULOSUS, Ramsay.

This bird is a native of the dense scrubs that are to be found in the neighbourhood of Rockingham Bay, and the Johnstone, Russell, and Mulgrave Rivers in tropical Queensland. They congregate in small flocks in the palms and fig-trees from which they obtain their food. During a recent excursion to the Mt. Bellenden-Ker Ranges, Messrs. E. J. Cairn and Robt. Grant, collecting on behalf of the Trustees of the Australian Museum, succeeded in obtaining, among others, a fine series of these birds in different stages of plumage; and besides finding several nests with young birds, they were fortunate in obtaining, although very late in the season, a nest containing eggs. The nest and eggs in question, which are exhibited here to-night, were found on December 2nd, 1887, in the fork of a sapling about seven feet from the ground, on the Herberton road at a distance of thirty-two miles from Cairns. The nest is a neat bowl-shaped structure composed of long twigs and leaves of a *Tristania* (?), lined inside with twigs and the dried wiry stems of a climbing plant; on the outside are several nearly perfect leaves of the *Tristania* (?) worked in, which partially obscure one side of the nest. Exterior

diameter seven inches, by four inches and a-half in depth; interior diameter four inches and three-quarters, by two inches and a-half in depth. Eggs two in number for a sitting, nearly true ovals in form, tapering but slightly at one end, of a uniform creamy white; the shell is thin, the surface being smooth and slightly glossy. Length (A), 1.67×1.11 inch; (B), 1.63×1.1 inch. Both parent birds were procured at the time of taking the eggs, which were in a very advanced state of incubation. In addition to finding a great number of nests several very young birds of *Macropygia phasianella*, *Ptilopus superbus*, and *Orthonyx spaldingi* were also obtained in the same locality, showing that the breeding season had just terminated. It is only right to mention that the eggs described above are not altogether what, from analogy, they might be expected to be, being quite different from those of any other species of the family *Scenopidae*. Messrs. Cairn and Grant, however, state that there can be no doubt as to their authenticity, the bird having been shot from the nest. (*Aust. Mus. Coll.*).

PHAPS HISTRIONICA, Gould.

In some seasons this beautiful pigeon is to be found in countless numbers on the vast plains of the interior of Australia; its range also extends to Port Darwin and Derby, North-western Australia, specimens having been procured at the latter place both by Mr. E. J. Cairn and the late Mr. T. H. Boyer-Bower during the latter part of 1886. In the evening these birds arrive in large flocks at all the dams and water tanks to drink, but at the slightest indication of danger they take to flight. The species is terrestrial in its habits, and for the purposes of breeding generally resorts to the shelter of a cotton bush, forming little or no nest but depositing the eggs upon the bare ground. A pair of these birds in the aviary of the Hon. William Macleay, laid two eggs this season, which after being sat upon for some time were deserted. Upon emptying them of their contents, Mr. George Masters, the Curator of the Macleayan Museum, informs me that one of them contained a young bird

fully formed. Eggs two in number for a sitting, in form oval, of a faint creamy white, the surface of the shell being both slightly roughened and glossy. Length (A), 1.3×0.93 inch ; (B), 1.22×0.92 inch.

These eggs are similar to specimens in the Dobroyde Collection, taken by Mr. J. B. White on the Barcoo River during July, 1868.

July and August are the usual breeding season of this species.
(*From the Macleayan Museum Coll.*).

NOTES AND EXHIBITS.

Mr. Skuse exhibited a collection of the Diptera described in his paper.

Mr. North exhibited the eggs referred to in his paper.

Mr. A. Sidney Olliff said he wished to call the attention of the members to the extraordinary abundance of *Belostoma indicum*, St. Farg. & Serv., (specimens of which he exhibited), a gigantic 'water-scorpion' belonging to the family Naucoridæ. The insect had appeared in such numbers during the last few months in various parts of Sydney, that it attracted the attention of even the most unobservant. It was most frequently observed in well-lit places in the city, light evidently having a great attraction for it. Early in November as many as twenty had been picked up under one of the electric lamps at the Circular Quay, where they had fallen half-stunned after their vain efforts at suicide in the light above. Mr. Olliff also stated that lepidoptera were attracted by the electric light, although not in such numbers as by the ordinary gaslight; he had himself obtained *Danima Banksice*, Lw., *Spilosoma fulvo-hirta*, W., *Heliothis armiger*, Hub., and *Idiodes apicata*, Gn., during an hour's searching at the electric lamps on one of the shipping wharves at Darling Harbour.

Mr. J. Mitchell exhibited (a) the Trilobites from Bowning described by him in a paper read at the Society's meeting in July last (Proc. 1887, p. 435), (b) specimens of a new species of *Acidaspis* to be described at a future meeting, and (c) specimens of two or perhaps three species of Graptolites from the Bowning Beds at Bowning and Bell Vale, found since the exhibition of the somewhat less satisfactory specimens previously brought under the notice of the Society (Proc. 1886, p. 577), which, it may be remembered, were the first recorded from N.S.W.

Mr. T. Whitelegge exhibited a mounted slide of *Haliphysema ramulosa*, Bowerbank, a curious Foraminifer growing in erect tree-like tufts, its test composed of sand grains and sponge spicules. This was originally described as a sponge, but subsequent observations proved it to belong to the Foraminifera. Also two slides of Polyzoa, one being *Pedicellina echinata*, Sars, and the other a species of *Cylindroecium* closely allied to, if not identical with, *C. giganteum*, Busk. The whole were collected under stones, at low tide in Middle Harbour, Port Jackson, and form interesting additions to our Marine Fauna.

WEDNESDAY, 29TH FEBRUARY, 1888.

The Monthly Meeting of the Society was held in the Linnean Hall, Ithaca Road, Elizabeth Bay, on Wednesday evening, 29th February, 1888.

The President, Professor W. J. Stephens, M.A., F.G.S., in the Chair.

The following gentlemen were elected Members of the Society :—
Mr. T. C. Burnell, Darlinghurst ; Mr. R. Etheridge (previously a Corresponding Member) ; and Mr. R. D. Fitzgerald, Junr.

The President made the following announcements :—

1. That the Council had elected Dr. B. Carrington, and Mr. W. H. Pearson, Eccles, England, Corresponding Members of the Society.
 2. That the next Excursion would take place on March 24th. Members to meet at the Botany Terminus on the arrival of the 10.6 a.m. tram from Bridge Street.
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DONATIONS.

“Journal of the Royal Microscopical Society, 1887.” Part 6.
From the Society.

“Mémoires du Comité Géologique, St. Pétersbourg.” Vol. II., Nos. 4 and 5 ; III., No. 3 ; “Bulletins.” Vol. VI., Nos. 8-10 (1887) ; et Supplément. *De la part du Comité.*

"Abstract of Proceedings of the Zoological Society of London, 20th December, 1887." *From the Society.*

"Abnorme Eberhauer, Pretiosen im Schmuck der Südsee-Völker." Von Dr. O. Finsch. *From the Author.*

"Zoologischer Anzeiger." Nos. 268 and 269 (Dec., 1887 and Jan., 1888). *From the Editor.*

"The Victorian Naturalist." Vol. IV., Nos. 9 and 10 (Jan. and Feb., 1888). *From the Field Naturalists' Club of Victoria.*

"The Australasian Journal of Pharmacy." Vol. III., Nos. 25 and 26 (Jan. and Feb., 1888). *From the Editor.*

"Proceedings of the Asiatic Society of Bengal, 1887." Nos. I-IX. (Jan. to Nov.); "Journal." Vol. LVI., Parts 1 and 2 (1887). *From the Society.*

"Mittheilungen des Vereins für Erdkunde zu Leipzig, 1886." Heft 1-3. *From the Society.*

"Naturhistorisches Museum zu Hamburg—Bericht des Direktor, 1886." *From the Director.*

"Abhandlungen aus dem Gebiete der Naturwissenschaften herausgegeben vom Naturwissenschaftlichen Verein in Hamburg." X. Band (1887). *From the Society.*

"L'Académie Royale de Copenhague—Bulletin pour 1887." Nos. 1 and 2. *From the Academy.*

"Feuille des Jeunes Naturalistes." No. 207 (Jan., 1888). *From the Editor.*

"Proceedings and Transactions of the Queensland Branch of the Royal Geographical Society of Australasia." 2nd Session, 1886-7. Vol II., Part 3. *From the Society.*

"Geological Survey of India—Records." Vol. XX., Part 4 (1887); "Memoirs." Vol. XXIV., Part 1 (1887); "Palæontologia Indica." Ser. x. Vol. IV., Part 3 (1887); "A Manual of the Geology of India. Part 4, Mineralogy." By F. R. Mallet, Superintendent, G.S.I. *From the Director.*

"The Journal of Comparative Medicine and Surgery." Vol. IX., No. 1 (1888). *From the Editor.*

"Geology of the Vegetable Creek Tin-Mining Field, New England District, N.S.W., with Maps and Sections." By T. W. E. David, B.A., F.G.S.; "Annual Report of the Department of Mines, N.S.W., for the year 1886;" "Royal Commission Conservation of Water—Third and Final Report of the Commissioners." *From the Department of Mines.*

"Prodromus of the Zoology of Victoria." Decades XIII., and XIV. By Frederick McCoy, C.M.G., Sc.D., F.R.S. *From the Government of Victoria through the Librarian, Public Library, Melbourne.*

"Annual Report of the Board of Regents of the Smithsonian Institution, 1885. Part 1. *From the Institution.*

"United States Geological Survey—Bulletins." Nos. 34-39 (1886-87); "Sixth Annual Report, 1884-85." By J. W. Powell, Director. *From the Director.*

"Annals of the New York Academy of Sciences." Vol. IV., Nos. 1 and 2 (1887). *From the Academy.*

"Bulletin of the Scientific Laboratories of Denison University." Vol. I; Vol. II., Parts 1 and 2 (1885-87). *From the University.*

"Bulletin of the American Museum of Natural History." Vol. II., No. 1 (1887). *From the Museum.*

"Bulletin of the California Academy of Sciences." Vol. II., Nos. 6 and 7 (1887). *From the Academy.*

"Proceedings of the Academy of Natural Sciences of Philadelphia, 1887." Part 1. *From the Academy.*

"Johns Hopkins University Circulars." Vol. VI., Nos. 56 and 57 (March and April, 1887). *From the University.*

"Mémoires de l'Académie Impériale des Sciences de St. Pétersbourg," 7^e Série. Tome XXXV., No. 1 (1887); "Bulletin." T. XXXI., No. 4 (1887). *From the Academy.*

“Catalogue of Transactions of Societies, Periodicals, and Memoirs, available for the use of Students in the Reading Room of the Radcliffe Library at the Oxford Museum.” Fourth Edition (1887). *From the Library.*

“Mittheilungen der Naturforschenden Gesellschaft in Bern aus dem Jahre 1886. *From the Society.*

“Comptes Rendus des Séances de l'Académie des Sciences, Paris.” Tome CV., Nos. 20-23 (1887). *From the Academy.*

“Oology of Australian Birds.” By A. J. Campbell. Supplement. Part 4. *From the Author.*

“The Ferns and Fern Allies of New Zealand.” By G. M. Thomson, F.L.S. *From Prof. W. J. Stephens, M.A., F.G.S.*

PAPERS READ.

DESCRIPTION OF FISH-REMAINS FROM THE "ROLLING DOWNS FORMATION" OF NORTHERN QUEENSLAND.

By R. ETHERIDGE, JUNR.

PALEONTOLOGIST TO THE AUSTRALIAN MUSEUM, AND GEOLOGICAL SURVEY OF NEW SOUTH WALES.

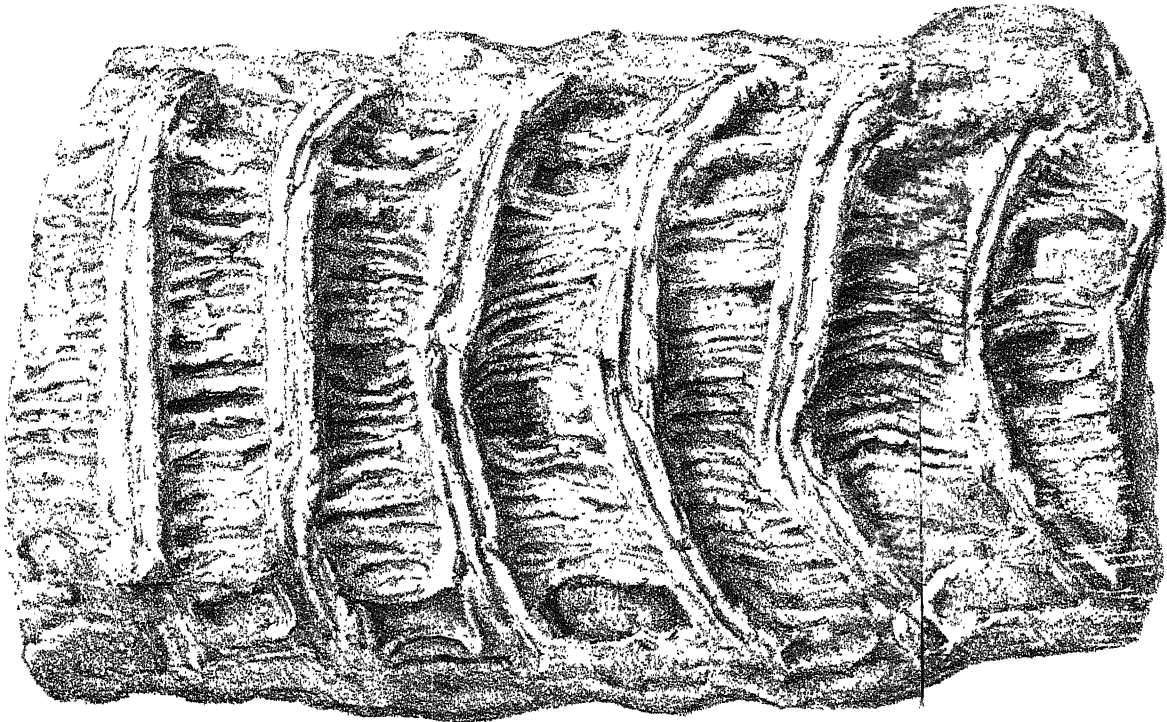
(Plate iv.)

The remains of fish in the Mesozoic rocks of Eastern Australia have hitherto been recorded, with two trivial exceptions, from the lower members of that great series only, locally known as the Hawkesbury-Wianamatta Group. The exceptions referred to are the occurrence of teeth and scales in the concretionary blocks of Wolumbilla, Central Queensland, mentioned by the late Mr. Charles Moore*, and referred to the genus *Lepidotus*; and the remains of an *Aspidorhynchus*†, found by my father amongst the gatherings of the late Mr. Richard Daintree, the first Government Geologist of Queensland.

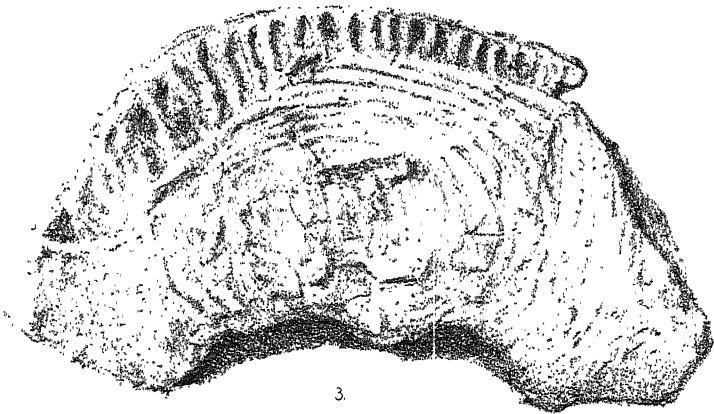
The recent surveys and explorations of my friend and former colleague, Mr. R. L. Jack, F.R.G.S., &c., have brought to light a large and most valuable store of organic remains from strata of all ages throughout Queensland. Not the least interesting are those from that immense stretch of rocks denominated by Mr. Jack the "Rolling Downs Formation," running with slight interruption

* Quart. Journ. Geol. Soc. XXVI. p. 238.

† Quart. Journ. Geol. Soc. XXVIII. p. 346.



2.



3.



1 OTODUS APPENDICULATUS

2 & 3. LAIINA D AVIESII

S Sedgfield, lith.

all through the centre of Queensland from north to south, and spreading out in the south to Goondiwindi on the east, and over the South Australian border on the west. This immense deposit is now believed to be homotaxial with the Upper Mesozoic beds of Europe, and in a great measure to represent that division known as the Cretaceous.

During the explorations carried on for the "Proposed Transcontinental Railway" by Major-General the Hon. W. Feilding, Mr. Jack collected largely in the valley of the Leichhardt River. At Kamileroy magnesian limestone was discovered, which, to use his own words,* "yielded specimens of shark's teeth, echinus spines and plates, belemnites, mollusca, &c.,—enough to prove that it formed part of the "downs" formation, the same which extends from Cloncurry to Hughenden." He also describes another similar limestone on Gunpowder Creek, a tributary of the Leichhardt, about nine miles from the mouth "full of small fish-teeth, fragments of chelonian plates, and belemnites, with a few shells."†

The specimen sent to me by Mr. Jack from Kamileroy is a shark's tooth referable to *Otodus appendiculatus*, Ag., and is described further on.

With the view of supplementing the collection of Queensland fossils now under description for Mr. Jack, I have been favoured by Mr. de Vis with a number from the Queensland Museum. Amongst these are some vertebræ of a large shark, probably referable to *Lamna*, from the "Rolling Downs Formation" at Richmond Downs, Flinders River.

The following is a detailed description of the fossils:—

* Reports on the Geological Features of Part of the District to be traversed by the Proposed Transcontinental Railway, by Robert L. Jack, &c., (fcap., Brisbane, 1885), p. 8.

† *Loc. cit.* p. 12.

Genus OTODUS, Agassiz, 1843.

(Rech. Poiss. Foss. Tom. III. p. 266.)

OTODUS APPENDICULATUS, Agassiz.

O. appendiculatus, Agass., Rech. Poiss. Foss., tom. III. p. 270, Atlas, tom. III. t. 32, f. 1-25.

Sp. Char.—A tooth of the upper jaw, nearly one inch in height from a line drawn between the fangs upwards to the apex, three-quarters of an inch across the root, and rather less between the fangs. The upper margin of the root describes almost an ellipse, the fangs being thick and obtusely rounded. The crown is rather more than half an inch high, rather flattened on the inner surface, and gently arcuate from before backwards, with the lateral or cutting edges and the apex sharp. The basal cusps are small, but prominent and sharp, the posterior of the two being the larger.

Obs.—I have been guided in referring this tooth to *Otodus* by the absence of marginal crenulations to the cutting edge, as in *Carcharodon*; the presence of the basal cusps distinguishing it from *Oxyrhina*; and by the extended or laterally spread-out form, as compared with the vertical and upright aspect of the teeth of *Lamna*.

This tooth is in all probability from the upper jaw, and from its arcuate outline somewhat posterior in position. The specimen was carefully compared with a large series of similar teeth from the Cretaceous rocks of England, and found to agree excellently with Agassiz's species, especially that form represented in his Pl. 32, f. 15, the present example being but slightly more arcuate.

Locality.—Limestone at Kamileroy, Leichhardt River, North-west Queensland (R. L. Jack, Esq.—Coll. Geol. Survey of Queensland, Townsville).

Genus LAMNA, Cuvier, 1817.

(Règne Animal, tom. II., p. 126.)

LAMNA DAVIESII, *sp. nov.*

Sp. Char.—Vertebræ four inches high, three-quarters of an inch in length, and with a transverse diameter of more than two inches. Outline of the centrums oval, with a slightly concave surface. Peripheral fissures very narrow and numerous, margins of the centrums prominent and rounded.

Obs.—The present very remarkable specimen consists of seven vertebræ of a Selachian fish, firmly united together, but slightly displaced obliquely from their normal position, and as a whole six inches in length. In all probability, from the difference in the height and transverse measurement, these vertebræ had to some extent an oval outline, but this may have been intensified by the oblique displacement they have undergone.

With our present unsatisfactory knowledge of the remains of this group of fish in bygone periods, it is difficult to decide on a genus for these remains, but there is a general correspondence to the excellent figures given by Agassiz of the vertebræ of extinct species of *Lamna*,* for it is quite clear that the whole of each centrum was ossified, as in the family represented by the genus in question. According to Agassiz's statement as to the number of the peripheral fissures in the anterior, posterior, and abdominal regions of the column, the present specimen would be those of the abdominal.

It must be the representative of a very large fish. The Australian Museum contains a *Carcharodon Rondeletii*, about nine feet long, with vertebræ the centrums of which are about half the size only of those in this fossil. Judging by these measurements, it would appear to Mr. J. Douglas-Ogilby, who has kindly gone into the question with me, and myself, that we have here the remains of a fish which must have been at least from 18 to 20 feet long.

* *Loc. cit.* t. 40^b f. 16-20.

I have much pleasure in affixing to this interesting fragment the name of my former colleague, Mr. William Davies, F.G.S., late of the Department of Geology, Natural History Museum, London, and whose knowledge of extinct Ichthyology is probably exceeded by no one.

Locality.—Richmond Downs, Flinders River (Mr. C. de Vis-Coll. Queensland Museum, Brisbane).

In the report previously quoted, Mr. Jack makes the following remarks on the Rolling Downs Formation* :—"Without entering fully into the question of the geological age of the Downs, I may mention that I believe the strata to form one continuous series representing part of the Cretaceous and Oolitic formations. Apparently they form from east to west a large synclinal trough, with an axis crossing the Flinders in the neighbourhood of Marathon. At the heads of the Flinders the lowest beds do not crop out, as they overlap the Palæozoic and Metamorphic rocks of the dividing range, and are covered by the basalt of the tableland. To the west of Richmond Downs, however, a gentle dip to the east brings up to the surface a series of strata which apparently occupy a lower horizon than those in the centre of the trough. From Hughenden to Marathon the strata consist for the greater part of grey shales, with nodules of magnesian limestone, and grey and brown sandstones, which are occasionally calcareous and nodular. Near Richmond Downs, where an easterly dip is for the first time distinctly observable, the limestones take a different character, and are distinguished by a cone-in-cone structure. Further west there are fewer shale beds, and thicker and browner sandstones. The latter are extensively veined with gypsum; and I have been informed by squatters and others that *beds* of gypsum are frequently met with in sinking wells. The whole series is fossiliferous."

* *Loc. cit.*, p. 2.

Selachian fish, to which the remains just described undoubtedly belong, first make their appearance in the Cretaceous rocks of other parts of the world, and it is exceedingly probable, from these and the other fossils of this formation, that it represents in a considerable degree some portion of that period.

EXPLANATION OF PLATE.

- Fig. 1.—*Otodus appendiculatus*, Ag. One of the posterior upper teeth.
Nat. size. Rolling Downs Formation, Kamileroy.
- Fig. 2.—*Lamna Daviesii*, Eth. jun. Seven vertebræ, probably of the abdominal region, showing peripheral fissures, &c. Nat. size.
Richmond Downs.
- Fig. 3.—*Ditto*. End view of a vertebra to show complete ossification.
Nat. size.

DESCRIPTIONS OF TWO HITHERTO UNRECORDED WEST AUSTRALIAN PLANTS.

BY BARON VON MUELLER, K.C.M.G., M.D., F.R.S.

PTILOTUS MACLEAYI.

Leaves small, from narrow- to ovate-lanceolar, flat, decurrent on their petiole, as well as the slender branchlets glabrous; spikes capitular, on short peduncles; flowers small, pale; bracts and bracteoles nearly as long as the calyx, glabrous, from a blunt base lanceolar, by their carinular venule conspicuously extended into a setaceous acumen; sepals lanceolar-elliptical, streaked in their lower portion, quite glabrous outside, the three inner beard-like invested inside towards the base with crisped hairlets; stamens much shorter than the sepals, or one only elongated; anthers dark-brown, blunt-ellipsoid; pistil glabrous; seed dark-brown or black, very shining, smooth.

Near King's Sound (W. Froggatt).

Leaves flat, equally green on both sides, $\frac{1}{3}$ - $1\frac{1}{2}$ inches long, not seldom some opposite-approximated; spikes in age short-cylindric; flowers hardly as long as those of *P. spicatus*. Rhachis subtlet cottony invested. Filaments tender-capillary. Style rather elongated; stigma minute, undivided; fruit narrowly hemi-ellipsoid, pointed; seed about one-twentieth inch long.

Named in honour of our great entomologist and ichthyologist, who generously placed his collector's botanic material at the writer's disposal.

The same plant is contained also in a collection of botanic specimens recently formed by Staff-surveyor Mr. Nynlasy near the Ord-River, and presented by the Hon. John Forrest to the Melbourne Phytologic Museum. The feature of the plant is almost that of *Allmania nodiflora*; but the pericarp

is not dehiscent transversely, but rupturing irregularly at last, as normal for *Ptilotus*.

Incidentally new localities of some congeners may here be noted :—

P. spatulatus, northward to the Lachlan-River (F.v.M.).

P. incanus, Finke-River (Rev. H. Kempe).

P. Beckeri, Kangaroo-Island (Prof. Tate).

P. helipteroides, Gascoyne-River (Hon. J. Forrest), Finke-River (Rev. H. Kempe).

P. Drummondi, Gascoyne-River (Hon. J. Forrest).

P. parvifolius, Lake Eyre (Prof. Tate), Grey's Ranges (Rev. W. Webster).

P. conicus, Croker's Island (Foelsche).

P. spicatus, King's Sound (Froggatt).

P. Fraseri, var. *Schwartzii*, near the Macdonell's Ranges (Rev. Mr. Schwartz).

Stems to about one and a half feet high ; calyx twice as long as the bracteoles, towards the middle red ; stamens partially sterile, the interjacent minute membranes acuminate ; ovulary glabrous ; fruit almost equilateral. These characteristics seem to be sufficient for raising this supposed variety to specific rank.

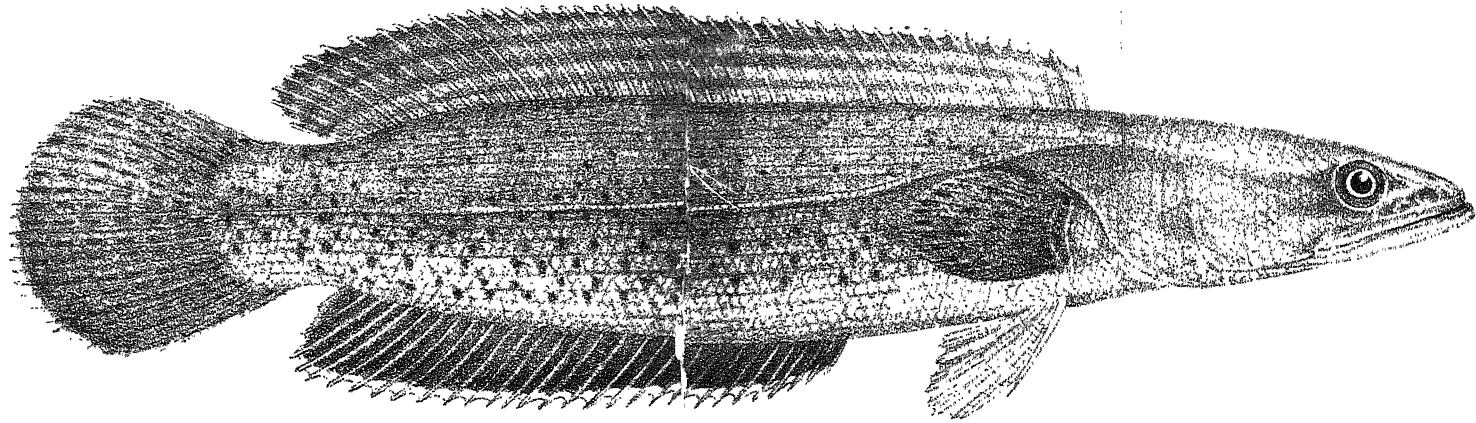
This is also an apt opportunity for pointing out that Professor H. Barillon recorded some time ago the anthers of *Polycnemum* as really unilocular, though apparently two-celled ; in a lithographed drawing of *Hemichroa pentandra*, printed with numerous others many years since for "The Plants of Victoria," but hitherto unissued, the anthers were also delineated already as unilocular ; as may likewise be seen in the xylographic illustration of *Polycnemum pentandrum*, published in the "Key to the System of Victorian Plants," II., figure 34, as copied from the above-mentioned lithogram.

ACACIA SPODIOSPERMA.

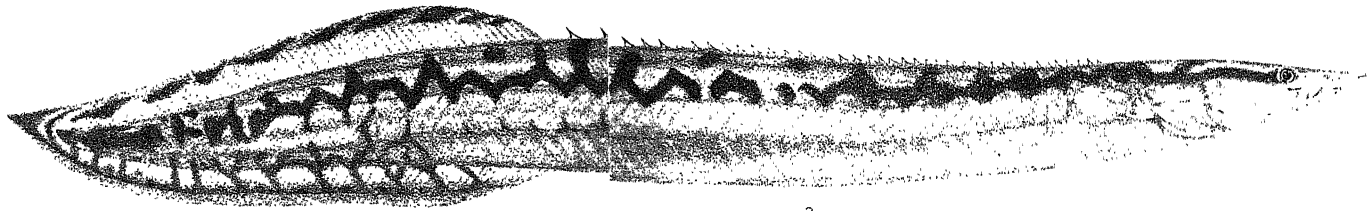
Glabrous ; branchlets whitish, cylindrical ; stipules obliterated ; phyllodes rather long, compressed-cylindrical, without any perceptible longitudinal venules, recurved-pointed, through exsiccation wrinkled ; headlets few-flowered, solitary or two or three above each other, on rather long stalks ; calyx lobeless, considerably shorter than the smooth corolla ; fruits few-seeded, comparatively broad, much compressed, generally arcuate-curved, only slightly attenuated at the base, deeply constricted between the seeds, hardly or tardily dehiscent ; pericarp rather thick ; seeds roundish, considerably compressed, brownish-white when nearly ripe ; areoles almost as wide as the whole seed ; arillar appendage very small, nearly semi-orbicular ; funicle brown, capillary quite short.

In the vicinity of Lake Austin (H. S. King, Esq.).

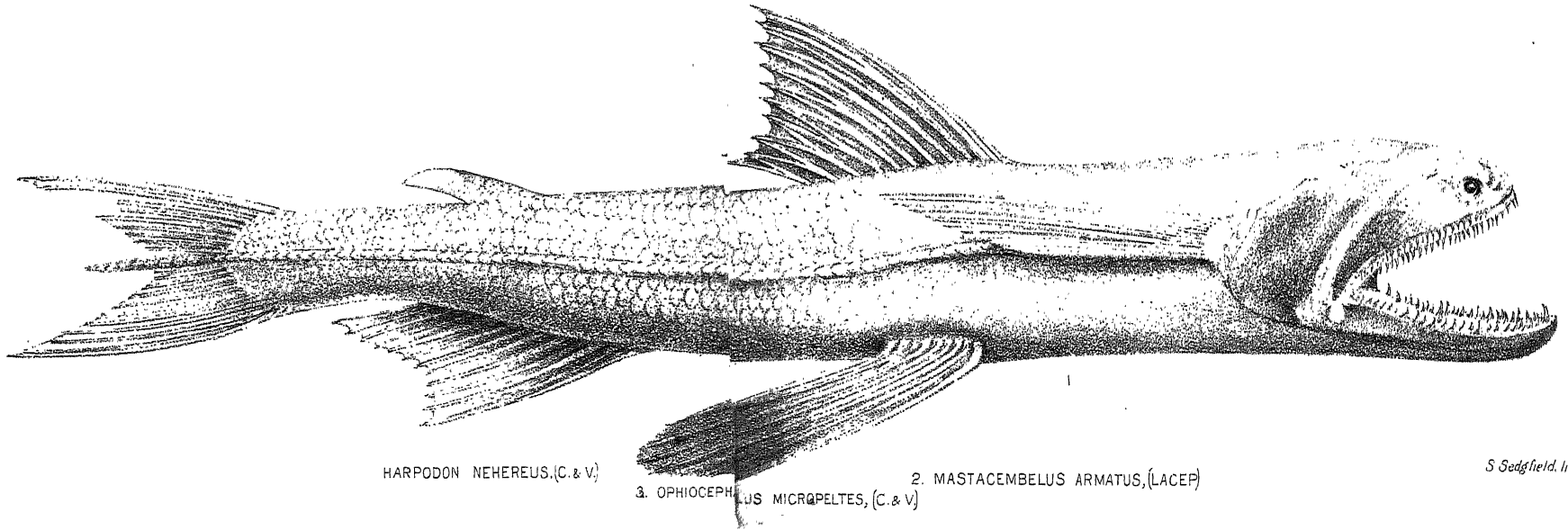
This species differs already from *A. scirpifolia* in shorter phyllodes with more curved apex, in fruits much wider dilated between the constrictions and in the minuteness of the arillus ; from *A. calamifolia* it is distinguished by the form of the calyx, by the broadness of the fruit, and by the roundish form and larger size of the seeds ; from both, moreover, and indeed from all other Australian congeners it is removed by the paleness of the seeds ; the latter, however, in a ripe state were not available, nor well-developed headlets of flowers yet for examination.



3



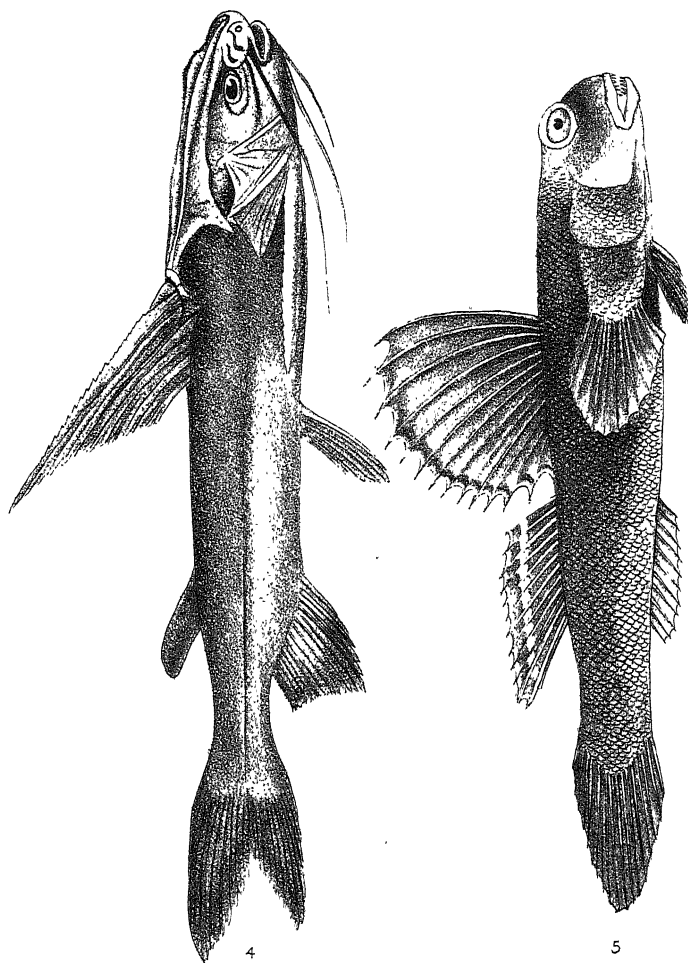
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HARPODON NEHEREUS, (C. & V.)

3. OPHIOCEPHALUS MICROPELTES, (C. & V.)

2. MASTACEMBELUS ARMATUS, (LACEP.)



4 ARIUS CŒLATUS, (C. & V.)
5. PERIOPHTHALMUS KOELREUTERI, (PALL)

Sedgwick, 1874

FISHERIES OF THE ORIENTAL REGION.

BY THE REV. J. E. TENISON-WOODS, F.G.S., F.L.S., &c.

Plates iv, and v.

By the Oriental region is meant the seas within the tropics on both sides of the equator from the longitude of the Himalayas to the Yang-tse-kiang including the islands east of Wallace's line, at least as far as about the meridian of the Caroline Group, the Solomon Islands, the New Hebrides, and New Caledonia. With the exception that the east and west meridional boundaries are arbitrary, the region included forms more or less a true zoological marine province and corresponds nearly with Dr. Günther's Indian region. It may also be called the Malaysian region, for the greater portion of the land included in it, with the exception of North Australia, is inhabited by Malay races.

In dealing with the fisheries of this region, however, it is not so much with Malay as with Chinese fishermen that we have to do. All that is interesting and all that is systematic throughout the province is accomplished by Chinese immigrants who have scattered themselves far and wide on these coasts. It is true to say that in Malaysia the Malay races confine their fishing with few exceptions to their own wants, while the fishing operations of the Chinese are for the purposes of trade and commerce. Few who are not intimately acquainted with the Chinese character can appreciate their extraordinary aptitude for business and trade, and a slight experience of the conditions of life in Malaysia readily explains why fishing absorbs so much of the labour of the coolies who settle on the coast. It scarcely requires explanation, but a few words on the subject will be of interest.

It is supposed that a tenth part of the population of China derives support from fisheries. To use the words of the editor of the *Technologist*. "Hundreds and thousands of boats crowd the whole coast, sometimes acting in community, sometimes independent and isolated. There is no species of craft by which a fish can be inveigled which is not practised with success in China. Every variety of net from vast seines embracing miles, to the smallest hand-filet in the care of a child. Fishing by night and fishing by day; fishing in moonlight, by torchlight and in utter darkness; fishing in boats of all sizes, fishing by those who are stationary on the rock by the sea-side, and by those who are absent for weeks on the wildest of seas; fishing by cormorants; fishing by divers; fishing with lines, with baskets—by every imaginable decoy and device. There is no river which is not staked to assist the fisherman in his craft. There is no lake, no pond which is not crowded with fish. A piece of water is nearly as valuable as a field of fertile land. At daybreak every city is crowded with sellers of live fish, who carry their commodity in buckets of water, saving all they do not sell to be returned to the pond or kept for another day's service."

The obvious reason for all this is, that with the exception of rice there is nothing that enters so largely into the domestic economy of the Chinese as fish; very nearly as much but not quite so extensively as with the Japanese, for until lately, the latter ate no meat at all, while the Chinese considerably supplement their fish food with pork, at least, if not with other meats.

Several circumstances combine to make China a great fishing country. The coast line is long and tortuous, besides having an extensive archipelago of islands. It has a magnificent river system with such a network of small tributary streams that no country can be said to be better watered. These natural advantages have been largely aided by systems of canals or channels of communication which water the vast plains in all directions.

Just as the insular situation of Great Britain has made its people bold sailors and given them dominion over the sea, so the physical character of China has made the people essentially fishers, and spread them over the east to teach nations that industry. For it is Chinese fishermen we meet everywhere in the east, and they are the only men who ply the trade in North Australia. The fishermen supplying the markets of the Straits Settlements are principally Chinese. In nautical skill the Chinese fishermen in the Straits Settlements are far behind the Malays. Although originally a sturdy race their morals and frames are deteriorated by gambling and opium. Their trade exposes them, in those latitudes at least, to little hardship, and their leisure, which is considerable, is spent idly if not viciously. The consequence is that though Chinese immigrants are gladly welcomed in general in the Straits Settlements, the fishermen are ever looked upon with suspicion.. They congregate in lonely little spots along the least inhabited parts of the coast of all the Malayan region, and in such places they are ready for anything. Piracy, robbery, murder,—nothing comes amiss. During my stay at Thaiping it became necessary for the Government of Perak to burn down one of the fishing villages between Port Weld and Penang, which had become a kind of piratical hornet's nest. I am sorry to say that I could give many other illustrations of the desperate and lawless character of this class.

The fishmongers of the East are also natives of China, but they are a class far superior to the fishermen. At all the fish markets that I have visited in certain places, namely :—in Singapore, Malacca, Thaiping, Penang, Saigon, Sulu, Menado (Celebes), Amboyna, &c., the fishmongers were Chinese. In Java it is not so for this simple reason : each nationality is confined to its own quarter and has its own market.

To deal with the Chinese fisheries in the East, for they are mainly Chinese, is a subject whose aspects are rather complex. Let us begin with the trade in the Indian Archipelago. The

coasts of the Straits of Malacca, whether on the Sumatran or Malayan sides, are extremely low and shallow. Large mangrove swamps with innumerable shallow streams fringe the shores. Vessels of even moderate draught must anchor a long way out. Sometimes, where the coast is scarcely visible, one meets a succession of bamboo fences, which are fishing stakes or fish traps of clumsy construction. They are closely woven labyrinths in which the fishes get entangled when the tide is in, and remain until the men come to make them captive. The fishing boats, of frail construction, vary from one to three tons burden. They are pulled by oars, and seldom carry sails, so that they do not venture far from shore. The nets are made of twine tanned with mangrove bark. The meshes are not constructed as in Europe, being knotted in a different way, with a fastening that slips and often allows fish to escape. The fishing stakes require very little trouble, and contribute largely to the take. They answer well enough in fine weather, and there is seldom anything else in the Straits of Malacca. The traps are neither ingenious nor durable, but the sea is rich in fish, and they are well sheltered. They form a conspicuous feature all through the Archipelago where the coast is shallow.

The fish trade comprises the following branches, viz.:—(1) fresh fish; (2) dried fish; (3) isinglass (fish-maws); (4) fish-roe; (5 and 6) red fish and “sardines;” (7) sharks’ fins; (8) baláchan; (9) fish manure; (10) tripang, or *bêche-de-mer*. A short description of each of these divisions will be given.

FRESH FISH.—The fish fauna of the Archipelago, including the marine and river species, amounts to about 400. This would make it about one-third less than some of the richest fish faunas in the world. The fishes of the Archipelago have received a considerable amount of attention, especially on the Indian and Malayan sides; but it may be doubted whether there are not a good many additional species yet to be described. It will be understood, therefore, that the above estimate is only approximate. No separation has been made between marine and fresh-

water fishes. In this matter it is hard to draw a reliable distinction. Many freshwater fishes come down to the sea, and many sea-fishes go hundreds of miles up freshwater rivers. However, the general habits of the two kinds require separate treatment. The fishes of the Indian Archipelago belong to what is called the equatorial region. The tropical Atlantic and Indo-Pacific regions are described separately, though the differences between them are neither numerous nor important. The majority of the principal types are found in both, and many of the species are identical. Dr. Günther (from whose essay on *The Study of Fishes* this summary is mainly taken) says that species are far more abundant in the Indo-Pacific region than in the Atlantic. Owing to the innumerable islands, the varying configuration of the coasts, the different nature of the sea-bottom, the long peninsulas, and the archipelagos, this part of the globe is rendered the most perfect for the development of fish life. It is not generally known that the fishes of the Indian and Pacific Oceans between the tropics are almost identical. Moreover, there is a very great number of species which range from the Red Sea and east coast of Africa to Polynesia. This Indo-Pacific fauna, however, does not extend to the Pacific coast of South America.

It would be tedious to go into much detail about the special characters of this region, but a few general conclusions will be of interest. Some 80 genera of shore-fishes are found in the Indo-Pacific region only, but these genera have with some exceptions only a few species. The sea-perches, of which our own *Serranus* or rock-cod is an example, are among the special types, though not confined to the region. They feed on small crustaceans and little fishes. Next follow the coral-feeding Pharyngognaths, which are most numerous in the Indo-Pacific region. They feed chiefly on small marine animals, and such as have compressed teeth appear to eat the crustaceans covering the banks round which these coral-fishes abound. Next follow the Squamipinnes, so-called because the soft and frequently spinous parts of their dorsal and anal fins are so thickly covered with scales that the boundary

between fins and body is entirely obliterated. They are mainly tropical and mostly found near coral reefs. The beauty and brilliancy of the colors of the *Chætodons*, *Heniochus*, and *Holocanthus* can never be forgotten by those who have once seen the glories of the deep. Such startling contrasts of the brightest colors, vermilion, carmine, shades of blue, orange, and the finest green meet one on every side, exciting one's admiration as much as the bright glories of the feathered tribes in these regions, forming a fitting accompaniment to the indescribable splendours of a coral reef. Their odd forms are also especially exceptional. They are small, and comparatively few are used as food. They feed on small invertebrates, and are rarely found in brackish water.

Next come the Murænidæ or Sea-eels, with long scaleless, snake-like bodies, and wide slits for gill openings. Then follow the Clupeidæ or Herrings, which are regular denizens of this region, and include some splendid food fishes, highly valued for their very delicate flavour. They include Herrings, Sardines, Anchovies, and the *Chanos salmoneus*, a fish valued as much as the salmon. Equalling these in number are the Carangidæ or Horse-mackerels, easily distinguished by the plate-like scales of the lateral line. Our own Yellow-tail in Sydney is an instance of this. The Horse-mackerels are favourite articles of food in the east, and one sees them in all the markets. I think they are the cheapest kind of fish. About 13 species of *Caranx* are known in the markets of Penang. They are at best but poor table fishes. Then follow the Scorpænidæ, a family distinguished by the spines and armature about the head and fins, with skinny appendages resembling the fronds of sea-weeds, which give to them a very formidable and ugly appearance. Generally their colour assimilates to their surroundings, that is an irregular mottling of red, yellow, brown or black. They are commonly small and ugly, with prominent ghost-like eyes, set in large, hollow, lantern-like sockets. They are esteemed as food by some. Wounds inflicted by their spines are exceedingly painful, probably from a poisonous mucus, but they are not followed by serious consequences.

Following these in importance are the Pleuronectidæ or flat-fishes, including the Soles and Plaice. They are pretty numerous, but do not seem in that region to include any highly esteemed food-fishes. Almost equal in importance are the Acronuridæ, inhabitants of tropical seas, and most abundant on coral reefs. This family includes the "Surgeons," so-called from the sharp lancet-shaped spine with which the tail is armed, which they use as a very dangerous weapon. They are brightly coloured and esteemed as food. The Sciaenidæ family, which in Europe includes the "Meagre" and many others of large size, almost all of which are eaten, contributes a large contingent to the fauna of the region. Also the Sygnathidæ or pipe-fishes which are no use as food at all. The Teuthididæ, which include 30 species, all from the Indo-Pacific region, amongst which is the Australian black and white "Trevally," are well-known fish in the east, with venomous spines. All the species are supposed by the Malays of the Straits to be highly poisonous; they are not eaten but are set aside amongst offal of fish to be used as manure.

The above list includes all the families characteristic of the region, but generic distinctions give no idea of the relative proportions of the number of individuals. Those fishes which frequent the seas in large shoals such as the Herring, Mackerel, and Anchovy, are far more commonly seen in the markets, and are abundantly consumed amongst the people. There are tunnies of large size, which seem favourite articles of food, called Tangiri pappan by the Malays (*Cybiium guttatum*, Bloch & Schn.). It attains considerable length, and, together with *C. lineolatum*, Cuv., and *C. commersonii*, Lacep., is cut up and sold piecemeal amongst the poorer inhabitants. I do not remember ever seeing a fish market in which tunnies and other members of the mackerel family were not the principal fishes offered for sale. They do not keep well in the climate, but if they are slightly turned this is a recommendation to both Malays and Chinese. The fish mostly consumed by Europeans is the Pomfret, of which there are three species, namely:—*Stromateus niger*, *S. sinensis*,

and *S. cinereus*. The first is the black Pomfret or Bawaltumbak of the Malays. It is taken in abundance in the Straits of Malacca at all seasons. It is broad and something like a flat-fish, and in the dried state is largely exported. It is considered inferior to *S. sinensis* or the white Pomfret, the "Pample blanche" of Pondicherry, and Bawal-chirmin of the Malays. Renowned for its flavour, it must be eaten fresh; abundant from the Coromandel coast to Hong Kong. *Stromateus cinereus*, Bloch, is a smaller species, and so is *S. argentius*, Bloch; both of good flavour and equally abundant.

The markets of the Straits Settlements and Archipelago do not usually contain as varied an assortment of marine food as one sees in the markets of China and Japan. But all kinds of fish-food may be said to be eaten, not excepting the little hopping-fish, *Periopthalmus koelreuteri*, Pallas, the Ikan lesah (restless fish) of the Malays. These are little blackish-olive fish, which occur in great numbers in the muddy mangrove swamps and streams. On approaching the water they may be seen making a series of rapid leaps along the surface and on to wet ground. Being true gobies they have strong pectoral and ventral fins by means of which they are able to adhere to the rocks. As far as my observation goes, they never remain in the water. In the Philippines I have seen them clinging round the rocks just at the water's edge, and on the approach of danger hop along the water to some other rock. Their eyes are very prominent, and can be moved independently of one another. Great numbers of them may be seen in the ditches round the fortifications in the Peninsula. It is not considered wholesome food, and is consumed only by the poorest classes.

I have already observed that it is difficult to make an absolute distinction between the marine and freshwater fishes, but still there are certain general differences which may be noted. The two principal families of freshwater fishes are the carps and the cat-fishes or sheat-fishes (Cyprinidæ and Siluridæ). The carps form

a third of all the freshwater fishes known, and the cat-fishes one-fourth. Carps seem to have spread all over the world, except Australia, South America, and the Pacific Islands. Many naturalists believe that they have spread from the Alpine region dividing temperate and tropical Asia.

The Siluroids being fond of warm, muddy, and sluggish waters, are, moreover, able to remain buried in the mud for long periods with little or no water. They are in Australia and South America, and in the Sandwich Islands, though not in the coral islands of the Pacific. A few species are found in the temperate parts of Europe, Asia, and North America, but not in Tasmania, New Zealand, or Patagonia. They are especially characteristic of the equatorial region.

The equatorial zone for the marine fishes extends about 30 degrees on each side of the line, reaching even further south on the eastern and western Australian coast. The boundary of the freshwater fishes differs much from this. It extends in undulating lines several degrees north and south. In Africa the Sahara forms a well-marked boundary. "The line, as it approaches the Nile," says Dr. Günther, "makes a sudden sweep towards the north as far as northern Syria," including some characteristic species near Aleppo and in the Tigris, as also well-marked Siluroid genera in the Sea of Galilee. It crosses through Persia and Afghanistan to the southern ranges of the Himalayas, and follows the course of the Yang-tse-kiang, which receives its contingent of equatorial fishes through the southern tributaries.

The equatorial zone is divided into the *Cyprinoid* or carp division, and that region from which carps are absent. It is in the carp division that the Malayan Peninsula is included with all the Indian region. This region is characterised by Ophiocephalidæ and Mastacembelidæ. The Ophiocephalidæ have a long body, covered with scales of moderate size; no spine in any of the fins, and the dorsal and anal fins long. These fishes though belonging to the Indian region, have one or two representatives in Africa.

In the Malayan rivers the species are particularly abundant, and some attain a length of two feet. Though not belonging to the Siluroids, they are able to survive long droughts by lying in semi-fluid mud ; "or in a torpid state below the hard baked crusts of the bottom of a tank, from which every drop of water has disappeared." They are so truly important in the Indian region that some length of detail in their description may be permitted.

The curious name given to these fishes by Bloch is obviously from their resemblance, in the head at least, to serpents. The body is almost cylindrical anteriorly, with a depressed head, having plate-like scales above. Cuvier remarked that if it were possible to admit such anomalous beings in nature, these strange fishes might be justly considered half fish and half serpents. Having hollow cavities in their heads and means for respiring air, they can live long out of the water and even travel over the ground, especially when it is moist. It is no uncommon sight in India and in China to see them called upon by jugglers and children to exhibit their skill in crawling. This they do in a serpentine manner, using their pectoral and caudal fins alternately like feet. They easily escape from aquaria unless the top is covered.*

The Malays call these Snakeheads Ikan-haruan ; the Chinese call them Shang-yu, and carry them alive in pails of water, cutting slices from them as they are sold ; a process which I have seen in many parts of China, practised on various kinds of fishes. They breed in grassy swamps or the edges of tanks, in well-walls and holes in river banks. One is said to build a nest among the vegetation near the edges of tanks, using its tail in building, and biting off the ends of the weeds. The male fish keeps guard over the ova, and the fry are nursed until old enough to get their own living. If they don't clear out then, they are sometimes remorselessly eaten. The young, as a rule, are more or less orange or scarlet, with longitudinal bands which disappear as they grow older.

* For information about the habits of these fishes the author is indebted to Cantor, Günther, Bleeker, and Day.

Those living in brackish water have a purplish tinge. They are all good eating. I remember buying one from a native who had just captured it in the Salama river. It weighed about seven pounds, and made an excellent curry that evening as we camped on the river banks. Mr. Francis Day says they are well adapted for pisciculture, as they thrive in almost any situation, being voracious and omnivorous. He carried one in a wet handkerchief on a journey of four hours, ascending 1000 feet, and it did not seem the worse for it. He thinks they prefer dirty to clean water. He says, "they are rather voracious, but appear to consider a frog, a mouse or a rat, as luscious a morsel as a fellow fish. When they have stirred up all the sediment and exuded a quantity of mucus they appear to be delighted, their colors become much more vivid, and they ascend to their favourite resort, lying amongst the vegetation just beneath the surface of the water. As soon as clean water is given them they become excited as if they imagined the time had arrived when they should change their abode."

"Amongst the fish which I have personally seen exhumed from the mud, where a tank had been dried up, are some Ophiocephali, whilst they are also the fish recorded by the natives of India as descending with the downpours of rain."*

How these fishes manage to subsist so long out of the water I shall refer to subsequently. Let me now mention the second family which is characteristic of the Indian region of the equatorial zone. This is Mastacembelidæ, a family which, to my mind, has far more title to the name of snake-fishes. They have long eel-like bodies, having a less repulsive appearance than *Muraena*, and rendered especially eel-like by a soft dorsal and anal fin at the tail only, and very small scales. The structure of the mouth and of the branchial apparatus, the separation of the humeral arch from the skull, the absence of ventral fins, the anatomy of the abdominal organs, afford ample evidence that these fishes are Acanthopterygian eels (Günther).

* Day, Fishes of India, Vol. I., p. 362.

Another peculiarity in the appearance of these fishes, is that they have a long, fleshy, pointed snout. On the structure of this snout depends the classification. It may be said to terminate in a pointed movable appendage, which is concave and transversely striated below in *Rhynchobdella*, and without the transverse striæ in *Mastacembelus*. There are only two genera in the family; in all 13 species. In the Perak river I have caught specimens of *Rhynchobdella aculeata* about 18 inches long. They are esteemed as the best of the eel-kind amongst fishes. Mr. Day says it is found in brackish waters within tidal influence, and throughout the deltas of large rivers, extending to Borneo and the Moluccas. It conceals itself in the mud, but dies if it cannot breathe air. In the Thaiping Museum, Perak, there is a kindred species which was found in the stomach of a snake very little bigger than itself.

Another characteristic of the Indian region is the number of Cobitidæ or Loaches, represented in such genera as *Lepidocephalichthys*, with eight or more barbels, a short dorsal fin and scales on the head; *Acanthopsis*, *Acanthophthalmus*, *Apua*, &c. All the species are edible, and I think are called "Balut" by the Malays, though probably the same name is applied by some to the *Mastacembelus* just described. I need hardly go more into detail to describe the Loaches, which are well-known from their peculiar bearded mouths, with scales minute or absent, and dull colours, with blotches and stains sometimes irregular and sometimes in fanciful patterns.

The Indian fresh-water fish region, according to Günther, comprises the whole continent of Asia south of the Himalayas and the Yang-tse-kiang. It includes Sumatra, Java, Borneo and Bali, with adjacent small islands. Borneo has a good many Cyprinoids, and, as far as my investigations go, they are more numerous in the Philippine Islands than Günther seems to think. According to the same authority, the region has received very little from outside its own limits. Formosa, though off the south coast of Asia and partly within the tropics, has a mixed fish fauna, as far as it is known, which is imperfectly. It includes a

Japanese salmonoid named *Plecoglossus*, which, however, is a very aberrant type.

The actual boundary of the Indian fresh-water fish region is difficult to define in South China, but the tributaries of the Yang-tse-kiang carry some of its species considerably north of the tropical line. Much, however, of the uncertainty as to the limits of genera and species, is owing to the little knowledge we possess of the countries through which the northern tropical line passes. Any conclusions that are formed now must only be considered provisional and subject to considerable modification.

Dr. Günther supposed that the fresh waters of Persia have been converted into brine and finally dried up by geological changes. Before this the streams were inhabited by many Indian forms, of which a few survive between Afghanistan and Syria. *Ophiocephalus* and *Discognathus* (Carp) have one representative each: *Macrones* (Siluroid) survives in the Tigris: *Mastacembelus* at Aleppo. Thus, he adds, Indian fresh-water fishes, with those of Africa and Europe, mingle in a district which connects the three continents:

There are thirty-nine families of fresh-water fishes known, of which twelve are represented in the Indian region. They number 625 species or two-sevenths of the known fresh-water fishes. Of these about 200 are Siluroids, and over 300 Carps. The preponderance of these two families is the speciality of the Indian region. There are no known Ganoid or Cyclostomous fishes, though they are present in every other region. We have, however, an *Osteoglossum*, one of the many families of the immense order of **PHYSOSTOMI**. *Osteoglossum* is a remarkable-looking fish; the body is covered with large hard scales, composed of pieces like tessellated armour: head scaleless, the skin being entirely replaced by bone: lateral line composed of wide openings of the mucous duct; dorsal fin on the tail opposite to the anal fin and very similar to it—both confluent with the rounded anal: mouth oblique, wide: lower jaw prominent, with a pair of barbels: pectoral fins long. The general appearance at first sight reminds

one of a ganoid fish. There are only three species known : *O. bicirrhosum* from the Brazils ; *O. formosum* from Borneo, Sumatra, and the Malay Peninsula ; *O. leichhardtii* from north and east Australia. From the fact that this fish is found associated with Sirenidae in every place except the Indian region, Dr. Günther concludes that a Dipnoous form will be found there too.

During my stay in the Malay Peninsula, I made several collections of fishes, but was not always fortunate in bringing them in a good state of preservation to Australia. Most of the fishes were obtained by purchase either directly from the Malays in their fishing boats or in the markets. A few were obtained by fishing with dynamite in some tributary streams of the Perak, such as the Kenas, and some of the mountain streams. The following is the list :—

ACANTHOPTERYGII PERCIFORMES.

Fam. SCORPÆNIDÆ.

CENTROPOGON (INDICUS ?), Day. In the brackish waters of the river Perak, where it was much feared by the natives on account of the spines about its head.

ACANTHOPTERYGII BLENNIIFORMES.

Fam. MASTACEMBELIDÆ.

MASTACEMBELUS UNICOLOR, Cuv. and Val. Perak river near Kuala Kangsa. Though named *unicolor*, it is brownish and has three or four rows of yellow spots or blotches along the sides. The vertical fins have also a yellowish margin.

MASTACEMBELUS ARMATUS, Lacep. Known as the thorny-backed eel amongst Europeans in India. Malay name Ikan-belida.

ACANTHOPTERYGII CHANNIFORMES.

Fam. OPHIOCEPHALIDÆ.

OPHIOCEPHALUS MICROPELTES, Cuv. and Val. Salama river, also the Kinta. This fish attains three feet in length, and is found on the Malabar and western coasts of India, Siam and the Malay

Archipelago. Its colors vary considerably. Old fish are greyish-brown ; but young ones, a foot or so in length, are orange-scarlet, with black bands. The scales are roughened in lines which along the body are arched.

OPHIOCEPHALUS PUNCTATUS, Bloch. Malay name Toman. It does not attain to such a size as the last, has much coarser scales, especially about the head, where they are large and irregular. The Europeans call it the black caboose. It prefers stagnant waters.

CHANNA ORIENTALIS, Gronov. Malay name Ikan-aroam or Seam. Perak River.

ACANTHOPTERYGII LABYRINTHIBRANCHII.

Fam. LABYRINTHICI.

*OSPHROMENUS OLFA*X, Commerson. This is the celebrated Gourami, which is also known as the Ikan-kalu amongst the Malays. Reputed amongst gourmets as one of the best flavoured fishes of the East: of clumsy form, becoming as large as a turbot. It is easily kept in captivity, and will live on fish, flesh, insects, and certain flowers. Many of the rich Chinese Towkays in Penang, Malacca, and Singapore keep these fishes in tanks, wells, or large earthenware baths, and they are used on special occasions at banquets. They become so tame as readily to come when called by their feeder, and will rise to flies, beetles, but especially the large red *Hibiscus rosa-sinensis*. When at Selangore with Sir C. Clementi-Smith, the "Capt. China" sent the governor one of these fishes in a large tank, so that it might not be killed until just before cooking. This was a civility which we received also in other places. The name is derived from *σφρησις*, nostrils, and *μηνη*, crescent, alluding to its peculiar smelling organs or *ὀσφρόμενος*, tracking by smell, which is again repeated in the name *olfax*. It is distinguished by its broadly oval shape, short dorsal fin, complicated labyrinthiform supra-branchial organ, and the very elongated filamentous first ray of the ventral fins.

BETTA PUGNAX, Cantor. This is the "Pla Kat" or fighting-fish of the Siamese, which is very common in all the fresh waters

of the Malay Peninsula. It is a very pretty little fish, olive above and deep blood-red below, with black bands from the head, and black edges to the scales. Head scaly and depressed, back slightly arched. Cantor says of this fish: "When it is in a state of quiet, with the fins at rest, the dull colours present nothing remarkable. But if two are brought within sight of each other, or if one sees its own image in a looking-glass, the little creature becomes suddenly excited, the raised fins and the whole body shine with metallic colours of dazzling beauty, while the projected gill membrane, waving like a black frill round the throat, adds something grotesque to the general appearance. In this state it makes repeated darts at its real or reflected antagonist. But both, when taken out of each other's sight, instantly become quiet. The description was drawn up in 1840 at Singapore, where a gentleman had been presented with several by the King of Siam. They were kept singly in glasses of water, fed with larvas of mosquitoes, and had thus lived for many months. The Siamese are as infatuated with the combats of these fishes as the Malays are with their cock-fights, and stake considerable sums, and sometimes their own persons and their families, on the issue. The license of exhibiting fish-fights is farmed, and affords a considerable annual revenue to the King of Siam." Cantor, "Catal. Malayan Fishes," p. 87.

Ord. PHYSOSTOMI—*Fam.* SILURIDÆ OR CAT-FISHES.

Mud fishes with naked skins or with osseous scutes, but without scales, barbels always present; air bladder generally present; communicating with the organ of hearing. All these fishes are furnished with formidable spines about the head, which give such venomous wounds that loss of limb or life sometimes results.

CLARIAS MAGUR, Bl. Ikan-keeba of the Malays. Common in fresh and brackish water, and attaining at least a foot and a half in length. It is said to be amphibious and will live long after its removal from water. The pectoral fin has a serrated spine, but covered with skin.

SILUNDIA SYKESII, Day. Ikan-batu in Malay. Long maxillary barbels, depressed and flattened form. I don't know whether this fish has been recorded previously from the Malay Peninsula, but it is not uncommon.

SACCOBRANCHUS FOSSILIS, Bloch, = *SILURUS FOSSILIS*, Bloch; Bl. Schn.; Swainson. Common in all the freshwater rivers from Scinde to China. Mr. Day says (*Fishes of India*, Vol. I., p. 487) wounds from the pectoral spine of this fish are dreaded in India as they are reported to be very venomous, even causing lockjaw. When captured the spine is broken off by blows with a stake. The fishermen dread it so much that they often cut the meshes of their net and allow it to escape. It is esteemed as food and considered invigorating, so tanks are stocked with them in the rainy season. They are easily fattened, quantity rather than quality of food being only requisite.

MACRONES JULIO, Ham. Buch. Called by the Anamites Ka-chuoc, and by the Malays Ikan-engior. Found in estuaries and rivers as far as the tides extend throughout the Indian Ocean, Archipelago and South China. Also common at Hué and Saigon, in fresh and salt water. Lurid, bluish-brown on back with red carmine fins, and eight barbels.

LIOCASSIS POECILOPTERUS, Günth.

ARIUS COELATUS, Cuv. and Val. Malay name Ikan-doonee or Saludu. A widespread species found in the mouths of rivers even beyond tidal influence throughout the Indian seas, that is from Bombay to the Malay Archipelago. It attains to a considerable size. It is of a bluish-black color above, white beneath, with a little yellow on the margins of some of the fins. I believe I have seen this species in some freshwater rivers, or on the coast in the Philippines.

CALLICHOUS BIMACULATUS, Bloch. Termed Butter-fish by Europeans in Bengal. The Hindoos call it Puff-ta. Extends through the fresh waters of India, Malaysia, and South China. The Anamites name it Ka-leo-muông. Malay name Ikan-keeba,

but I am doubtful of the application of this term. This species is very common.

Fam. CYPRINIDÆ OR CARPS.

The Carp family is so numerous in the fresh waters of Europe, Asia, and North America, that even the genera require to be subdivided into groups. There are none in Australia, but they are well represented in the Indian region. The first group is CATOSTOMINA or Suckers, best represented in North America, though two are known in eastern Asia. The second group, CYPRININA, includes most of the Indian fishes.

LABEO NANDINA, Ham. Buch.

LABEO FIMBRIATUS, Bloch. Attains a foot and a half in length and is good eating.

BARBUS BURMANICUS, Day. Called by the Malays Temen-galan.

BARBUS TOR, Ham. Buch. Malay name Temoleh. This fish is the celebrated Maha-seer of sportsmen in India. It shows great variation in the length of the head, which augments in proportion to the size of the fish. They are largest and of greatest abundance in mountain streams, which are rocky (Day). To my mind it is a poor, tasteless fish, almost uneatable from the number of bones.

BARBUS NEILLI, Day. Malay name Kereh. Day states that he has seen a specimen of this fish 38lbs. in weight, but it is said to reach 50 and 60lbs.

BARBUS STRACHEYI, Day. = *BARBUS MALABARICUS*, Day. Named after General Strachey. Malay name Klah.

BARBUS HEXASTICHUS, M'Clelland. Malay name Sebarin. Grows to three feet in length.

BARBUS JERDONI, Day.

BARBUS APOGON (Kuhl) Cuv. and Val. A small species, widespread through Burmah and the Malay Peninsula. Malay name Tempras.

BARBUS KOLUS, Sykes. Malay name Ikan-klah.

THYNNICHTHYS SANDKHOL, Sykes, Trans. Zool. Soc. II., p. 363.

DANGILA BURMANICA, Day. Malay name Ikan-kawan.

OSTEOCHILUS CHALYBEATUS, Cuv. and Val.

BARILIUS GUTTATUS, Day. Malay name Ikan-seluang. This genus belongs to a different subdivision of the carps.

Fam. CLUPEIDÆ OR HERRINGS.

ENGRAULIS SETIROSTRIS, Brouss. This is a little silvery anchovy with a golden yellow caudal fin. It extends from the Indian Ocean to south China. Named at Saigon Ka-la-tre by Anamite fishermen.

ENGRAULIS MYSTAX, Bloch. Silvery with greenish back. Caudal fin bordered with black, and a large striated black spot behind the operculum. At Penang and Singapore specimens about eight inches long are seen all the year round in the markets.

ENGRAULIS COMMERSONIANUS, Lacep. The well-known and highly esteemed Ikan-merah or red-fish of the Malays. It is known as white-bait amongst Indo-Europeans, and is captured in the Indian seas in great numbers. Day says it attains to eight inches in length, but I have never been able to obtain one more than half that size.

ENGRAULIS INDICUS, Hasselt. This fish is united with the preceding by Cantor as one species; but the red-fish is silvery, greenish above, a large black spot, sometimes indistinct, just behind the occiput, with a broad silvery band along the sides from the gills to the tail. *E. indicus* has very much the same colors, and is in fact difficult to distinguish; but the snout projects more, and the maxilla is truncated opposite the mandibular joint, while in the true red-fish it reaches the gill-opening.

CLUPEA BRACHYSOMA, Bleeker, = KOWALA THORACATA, Cantor, = ALOSA KOWAL, Günther. This fish is the species described by Cantor, says Mr. Day, and is known from the east coast of Africa through the seas of India, the Archipelago and south China.

CLUPEA ILISHA, Russell, = ALAUSA PALASAH of Cantor. In Malay Trubn. Cantor gives a long account of the preparation of the species, which will be referred to presently. It is called Sable-fish and Hilsa by Europeans. It is a silvery fish shot with gold and purple, no spots on the adult, but a row of them on the young, most distinct near the gills. Shoals of these fish swarm up the lower rivers as soon as the monsoon commences, especially those in which the current is not rapid. In the Philippines they are largely caught at this time, but Mr. Day says that great injury is done to these fisheries in India by the weirs without passes for the fishes to get to their spawning ground. He says they continue ascending the rivers for four months though in smaller quantities. In the Malay Peninsula the seasons seem to correspond with those of India.

COILIA BORNEENSIS, Bleeker. Kalanh-kanh of Anamite fishermen. A golden anchovy with yellow fins; pectoral fin with twelve free rays extending half way down the elongated, compressed, and tapering body. This species is very wide-spread in India, Cochin-China, and the Malay Archipelago.

The above list includes only those which came under my own observation and the number of course might be very much extended. No complete census, I believe, has yet been made of the fishes of the Archipelago or the Straits of Malacca, the latter of which would be of more interest to those enquiring into the true characters of the Malayan region. The following families are peculiar to the fresh waters of the Indian region.

LUCIOCEPHALIDÆ, 1 species.

OPHIOCEPHALIDÆ, 30 species (1 in Africa).

MASTACEMBELIDÆ, 10 species (3 in Africa).

Amongst the SILURIDÆ the following sub-divisions are restricted to the same region :—

CHACINA, with 3 species.

BAGARIINA, 20 species.

The following sub-divisions though not restricted to the Indian region, are largely represented there, as the following figures will show :—

CLARIINA, 12 species.

SILURINA, 72 species.

BAGRINA, 50 species.

ARIINA, 40 species.

Of carps, there are 190 species belonging to the sub-division CYPRININA, while DANIONINA and ABRAMIDINA (breams), have each 30 species.

The sub-divisions peculiar to the region are RASBORINA (20 species), SEMIPLUTINA (4 species), HOMALOPTERINA (10 species). The Indian region also has 50 species of loaches. These, with a few rare and small sub-divisions make up in all 325 species which are known to exist in the region. This census will be largely increased of course as the country is better explored.

For comparison with the above list, the following census of fishes found in the river Hué in Ton-kin by Dr. Tirant (Administrator of Native Affairs and Mayor of Cholon) is submitted.

1. LATES CALCARIFER, Bloch.
2. SERRANUS MALABARICUS, Bloch.
3. LUTJANUS JOHNNII, Bloch.
4. L. ARGENTIMACULATUS, Forsk.
5. AMBASSIS KOPSI, Bleeker.
6. THERAPON JARBUA, Forsk.
7. DATNIOIDES POLOTA, Ham. Buch.
8. GERRES FILAMENTOSUS, Cuv. and Val.
9. G. LUCIDUS, Cuv. and Val.
10. SCATOPHAGUS ARGUS, L.
11. TOXOTUS CHATAREUS, Ham. Buch.

12. CHRYSOPHRYS RUBROPTERA, Tirant.
13. GYMNAPISTUS TRACHINOIDES, Cuv. and Val.
14. TEUTHIS CONCATENATA, Cuv. and Val.
15. POLYNEMUS TETRADACTYLUS, Shaw.
16. UMBRINA RUSSELLII, Cuv. and Val.
17. CARANX HIPPOS, L.
18. C. LEPTOLEPIS, Cuv. and Val.
19. EQUULA EDENTULA, Bloch.
20. E. BREVIROSTRIS, Cuv. and Val.
21. E. INSIDIATRIX, Bloch.
22. CYBIUM KÜHLII, Cuv. and Val.
23. SILLAGO MACULATA, Quoy and Gaim.
24. GOBIUS TENTACULARIS, Bleek.
25. G. BIOCELLATUS, Cuv. and Val.
26. G. GIURIS, Ham. Buch.
27. G. PHILIPPI, Tirant.
28. ELEOTRIS CAPERATA, Cant.
29. TRYPAUCHEN VAGINA, Bloch.
30. CALLIONYMUS LONGICAUDATUS, Tem.
31. MUGIL STRONGYLOCEPHALUS, Richards.
32. OPHIOCEPHALUS STRIATUS, Bloch.
33. ANABAS SCANDENS, Dald.
34. OSPHROMENUS TRICHOPTERUS, Pall.
35. SYNAPTURA ORIENTALIS, Bloch.
36. ARIUS THALASSINUS, Rüpp.
37. MACRONES GULIO, Ham. Buch.
38. PANGASIVS MICRONEMA, Bleek.

39. *P. MACRONEMA*, Bleek.
40. *AMBLYCEPS MANGOIS*, Ham. Buch.
41. *CALLICHOUS MICROPUS*, Bleek.
42. *C. BIMACULATUS*, Bloch.
43. *CLARIAS DUSSUMIERI*, Cuv. and Val.
44. *C. MAGUR*, Ham. Buch.
45. *HARPODON NEHEREUS*, Ham. Buch.
46. *HEMIRHAMPHUS LIMBATUS*, Cuv. and Val.
47. *HAPLOCHEILUS ARGYROTÆNIA*, Tirant.
48. *CYPRINUS CARPIO*, L.
49. *CARASSIUS AUREUS*, L.
50. *OSTEOCHILUS TRIPORUS*, Bleek.
51. *O. MELANOPTERUS*, Tirant.
52. *BARBUS AUREUS*, Tirant.
53. *DANIO RHEINARDTI*, Tirant.
54. *MISGURNUS ANGUILLICAUDATUS*, Cant.
55. *SQUALIOBARBUS ANNAMITICUS*, Tirant.
56. *CULTER FLAVIPINNIS*, Tirant.
57. *ENGRAULIS SETIROSTRIS*, Brouss.
58. *E. MISTAX*, Bloch.
59. *CLUPEA HUÆ*, Tirant.
60. *C. LILE*, Cuv. and Val.
61. *COILIA BORNEENSIS*, Bleek.
62. *CHATOESSUS MACULATUS*, Richards.
63. *CHIROCENTRUS DORAB*, Forsk.
64. *NOTOPTERUS KÁPIRAT*, Lacep.
65. *MURÆNESOX CINEREUS*, Forsk.

66. *OPHICHTHYS BORO*, Ham. Buch.
67. *ANGUILLA BENGALENSIS*, Gray.
68. *TRACANTHUS BREVIROSTRIS*, Günth.
69. *CARCHARIAS LATICAUDUS*, Mull. and Hen.
70. *TRYGON WALGA*, Mull. and Hen.

It has been the custom of late years amongst naturalists to speculate upon the reasons for the peculiar character of the land and water fauna in every country, and to attribute them to geological changes. It is not so certain that geology is responsible for all she is made thus to bear; but whether she be so or not, I think they go a little too far when they proceed to describe circumstantially the precise geological changes which have taken place. Here theory has been overstrained; we are required to believe in the relative ages of different portions of islands and continents which are said to have remained dry land and so forth, from remote geological epochs. We can acknowledge that the problems to be accounted for are very intricate and puzzling, but it seems to me they are best left as problems.

Mr. Day says in his introduction to the "Fishes of India" (p. xiv.) "Omitting for the present from whence the type forms of vertebrate life were derived, we require to know how it is that some of the identical species of fish are found along the Western Ghauts of India, and in the Himalayas, but absent from the sub-region of Hindostan? and how is it we see some genera identical in Ceylon and in the Malay Archipelago, or in China, but absent from India and Burma."

"The presence of certain Chinese, Malayan, Burmese, and Siamese forms in Ceylon and in the Western Ghauts, with their absence in the intervening alluvial plains of Hindostan, leads to the supposition that, at an antecedent date, some connection existed between these earlier geological formations and the more eastern countries. We observe some identical forms in the island of Ceylon and in Java or China, but absent from intervening localities: but does this prove more than that those intervening stations have passed away."

I need not follow Mr. Day further. This extract will show the nature of the problems to which reference has been made. He thinks that in the alluvial plains of Hindostan there appear to be traces of two fish faunas, one from the north and one from the east from Malaysia. Dr. Stoliczka considers that the Indian plains had once a wholly Malayan flora.

In the census of the Indian fishes given by the same author in the Journal of the Linnean Society (Vol. XIV. Zoology, p. 560) he says that the element most apparent amongst the Indian freshwater fishes is the Malayan. There is not a single genus which is solely African or Indian, and all the African forms which extend to India are either likewise present in the Malay Archipelago, the Palæarctic region, or in both.

I pass now to other considerations connected with the fish and fisheries. The true Malay population on the rivers of the interior is so small that it is difficult to estimate the proportion of those who give themselves to fishing. The rivers are the highways of the interior, and the agriculture of the country is confined to their banks. This population engages in fishing as one of the means of livelihood. One meets them in their frail canoes on the rivers, in small parties of three or four, capturing their fish by hand-nets, lines, and sometimes, though rarely, spears. At night torchlight fishing is also resorted to. A great blaze is made upon the water with bamboo torches, and the fishes are struck with a long parang or hatchet-knife as they come to the surface. One sees no fishing-weirs or stream nets from one bank to another, but fish traps of various constructions are common. When at Pekan on the Pahang River, I remarked that the fishing boats, which were half-decked junks with one mast, and crews of five or six, went out beyond the bar of the river every morning when the tide served. The fish they brought back each afternoon were poor and small, and confined to a few species. I noticed the following genera which were purchased by the people from the boat side:—*Serranus* and *Plectropoma*, of the Scorpenidæ, *Scorpena*, *Sebastes* and *Centropogon*, *Caranx* and *Psettus*, some mackerel including a large

tasteless *Pelamys*, various mullets, *Sillago*, some Therapons and Siluroids, a few Herrings, Eels, and many Dog-fish, Saw-fishes, shovel-nosed Sharks and Rays.

But if the human enemies of fishes in the Malayan region are but few, it is not so with their other pursuers. First of all must be enumerated frogs, which are the most persistent and wide-spread devourers of fish ova that are to be found. In return the fish devour a good many frogs and their ova too. There is a fish-eating small crocodile, not the Ganges Gavial which does not come down so far as the Malay Peninsula, but uncommonly like *Phyllus johnstonii*, the fish-eating crocodile of North Australia. The snub-nosed or man-eating crocodiles, *Crocodilus porosus*, Schn., and *C. palustris*, Lesson, are found in many of the rivers along their whole course, but I do not think they are very numerous except in a few secluded streams where they are not disturbed. They consume an enormous quantity of fish. Otters too, are more destructive than any one would believe who has not had experience of their depredations. They are very common and sometimes used by the Malays to frighten the fish to the surface. But the feathered tribe supply the largest and most destructive contingent. The cormorants alone destroy fishes to an incredible extent. I have seen specimens shot with a dozen medium-sized fishes in their stomachs.

In 1884 I spent some weeks dredging at Pankore, one of the Dindings or Pulo Sembilan (nine islands), situated near the mouth of the Perak river, in the Straits of Malacca. I had a small steam launch named the Kimta, lent to me by the Perak Government. In dredging I was rather unsuccessful, for the muddy estuarine bottom near the coast was most unfavourable, while all the islands had fringing reefs of coral, where dredging was impossible. I did better in fishing, but this was by going out in a prahu with the Malays. We had a seine net and fishing lines. Pankore is the largest of the islands, and there is a considerable population of Chinese and Malays at the village, which is called Rajah Byong. The Chinese, with the exception of a

storekeeper or two and gardeners, were entirely occupied in fishing, for which purpose they had junks of the regular Chinese pattern. They had a considerable area of bamboo staging; the floor composed of open split bamboo, on which the fish was placed to dry in the sun. On the arrival of the junks the fishes were taken out, and the heads and entrails removed, with a partial rubbing off of the scales. Water was repeatedly poured over them till they were thoroughly washed free from blood. When quite clean they were put into casks in layers, with a thick coating of salt between the layers. They were allowed to remain in this for two or three days, according to the season, and then laid upon the bamboo staging to dry in the sun. In the Straits of Malacca, as in all the Archipelago, there is not much sunshine. Moreover, it rains nearly every day, in tropical showers which are neither light nor brief. These conditions are very much opposed to fish-drying, and before the fish could be finally stowed away, the "Ikan kering" or dried fish was in a semi-putrid condition. This state of things was aided to a considerable extent by the uncleanly habits of the Chinese. The heads and entrails of the fish were thrown into the water and on to the beach, and left to rot in the sun, with results which can be easily guessed. The effluvium around the village of Rajah Byong was unbearable to those who had not been inured to it by previous education.

Whenever the wind blew from the village, towards our quarters, we had to leave the house. Our Chinese servants, in spite of every prohibition, spread their mats under the bungalow at night, and exposed themselves to the full force of these mephitic breezes. The consequence was, they were all stricken down with fever, and some nearly died. Pankore has the name of being a very unhealthy place, but the marvel is how anybody lives there at all. The inhabitants suffer much from what is called malarial fever, but the malaria here is undoubtedly mephitism from putrid fish offal.

Yet in spite of these disadvantages, the dried salt fish of the Chinese is not such bad food. Where meat is almost unobtainable,

or if obtained is coarse and uneatable, the dried salt fish is the only article of food to be relied upon, and, so far as my experience goes, it is both palatable and nourishing. It is soaked and cut up into small dice, and fried until quite brown. A small quantity of this mixed with boiled rice makes a dish, which Chinese, Malays and Europeans seem equally to relish. I feel that I owe a debt of gratitude to this 'Ikan kering,' which I can only now imperfectly repay. When travelling through the wild, untrodden jungle, with much fatigue, and little to get in the way of nourishment, except the inevitable and most insipid rice, Ikan kering came as a boon and a blessing. The insipidity of the rice modified the fiery saltiness of the fish, and toned it down into various flavors. It supplied just what was needed to endow it with savor, and cause the most tasteless thing in the world to be relished. For my own part I could always make a sufficient meal on rice and Ikan kering, and so could my companions, which is more than can be said of any other aliment. Moreover, it can be obtained from every Chinese store throughout Malaysia.

Both in Java and the Peninsula fish-fry are dried without cleaning, and are sold to be eaten raw; but another kind of preparation which one meets with everywhere in the East, is the Ikan merah or "Red fish." This is one of the most agreeable delicacies of the East. It is made from *Engraulis commersonianus*, as already stated. The following is the mode of preparation as described by Cantor. In fine weather the fishes are caught in small nets, from shoals which frequent the shore. I have captured thousands of them in this manner in the month of July. After the heads have been removed from those of the medium size, which are the best for the purpose, the fishes are placed in flat, glazed, earthen vessels. Here salt is thrown on them to the extent of an eighth part of the weight of fish. They are then covered with plantain leaves and heavy weights for three or four days. They are next freed from salt, and soaked in vinegar made from palm-toddy. Those who know how sour the toddy is, even when considered drinkable, can guess how strong toddy-vinegar is. Powdered ginger and black pepper-corns

are added. In some places alcoholic spirits are infused, but I think this can only be to please the taste of Europeans, for the Mahometans would object to use spirits, and it could not be obtained in many places where Red-fish is prepared. Finally, powdered "Red-rice" is superadded for the coloring matter. Mr. Cantor, following information obtained from Malacca, says that Red-rice is the variety of *Oryzia sativa* called *glutinosa* (Bras pulut or Bras sepulut of the Malays). The red color is said to be derived from Cochineal. This may be the case at Malacca and Bencoolen, but in most places it is obtained from Arnatto, which is the colouring matter surrounding the seeds of *Bixa orellana*. After a certain time, during which the condiment is left in the pickle, a little more vinegar is added, and the bottles sealed up for sale. It is sold for about half a dollar a bottle. As a relish there is nothing equal to it. Those who are accustomed to dine in the native fashion, have with the curry and other dishes, condiments and sauces, served up in little plates on a tray. These are called 'Sambals,' which is the Malay name for condiment or seasoning. One counts as many as 23 or even more, on little plates, amongst which Ikan merah is always to be found. Most of the 'Sambals' are compounds of chillis and capsicums of the most fiery kind, meant to give an additional glow to the curry. It requires a long seasoning with Malay dishes to be able to bear the majority of the condiments, but red-fish is a Sambal of a type which is a favorite with all.

FISH ROES or "Telor Ikan" are very popular articles of food amongst the Malays. There used to be an extraordinary fishing station in Sumatra at a place called "Bukit Batu," (stone-hill) in the strait formed by the island of Banka. The fish caught have been already referred to, and the fishery is thus described by Mr. Moore.*

"The fish is called by the Malays 'Trubu.' It is known in all the neighbouring seas, but found with a roe only here, which makes it certain that it repairs to this favoured place for the

* Notices of the Indian Archipelago, &c., p. 29.

purpose of spawning, (that is to say, in shoals, for it is always plentiful at Penang, Malacca, and Singapore). The Trubu, about a cubit long, is taken in three or four fathoms of water on a mud-bank. About 300 boats are engaged at all seasons in the fishery, with the exception of four days, during dead neap tides. The roes are exported and the dried fish sent into the interior of the island. The Rajah of Siak derives an annual revenue from this fishery of 72,000 rupees, though the sum varies in proportion to the take."

This was more than 40 years ago, and I believe it has even increased since then, so that the amount of fish captured must be very large. The mode of preparation of the condiment is this. The fish is opened and the roes taken out and thoroughly salted; and then they are dried in the sun, so as to leave them still flexible, and capable of compression. They are then tightly packed in casks for exportation. The salting is never very effectually done, so that the eggs become changed in flavour after a time. They are very much consumed in China, exported from Singapore and Penang, but the Chinese generally re-salt them and add a little arrack before they send them away. They are about eight inches long and of a beautiful amber colour. They require soaking to get rid of the superfluous salt, and are generally fried. They are highly esteemed, but to my mind seem rather tasteless, besides being exceedingly rich and indigestible.

ISINGLASS.—Isinglass has long been an export from Malaysia to China. It is unnecessary now-a-days to inform readers that isinglass is derived from fish-maws, or sounds, or stomachs and air bladders. It is generally supposed that it is derived solely from the sturgeon of European rivers, but there are various kinds, which, as this is not a complete treatise on the substance, need not be further described. The isinglass with which we have to deal, is known in commerce as East Indian isinglass. Ever since the Chinese have emigrated into Malaysia they have exported East Indian isinglass into their own country. It has proved a most profitable trade, as fish-maws of certain kinds are much

sought after and valued in China. Not only has Malaysia been a source of this trade, but the Chinese dealers at Penang, Malacca and Singapore, have bought up isinglass from Bombay, Ceylon, Madras, Bengal, Tenasserim and Manila for export to China. The Indian specimens, however, which include those of Malaysia, are not highly esteemed. Most of them have an unpleasant fishy odor, which unfits them for domestic use, and greatly reduces their commercial value. They consist of an unopened swimming bladder, flattened and dried. The shape is roughly oval, from seven to nine inches long, three inches wide, the largest weighing a little over a quarter of a pound. They are dark in color and have a strong fishy odor. Another kind (East Indian leaf-isinglass), is merely the sac laid open and dried. It is wider and thicker than the last.

The following is a list made by Dr. Theodore Cantor of the Malayan fishes which yield isinglass. The list was made in 1850, when the scientific nomenclature of fishes was in a very unsatisfactory state. Dr. Cantor's names and identification are often wrong, and in rectifying them his names have been preserved for reference.

MALAYAN FISHES YIELDING ISINGLASS.

LATES CALCARIFER, Bloch. Malay name Ikan siyakup. This fish is found in the seas, back-waters and mouths of tidal rivers in the East, from the mouths of the Indian Rivers to the Malay Archipelago, Australia and China. I have caught this fish with a line in the Mary River 200 miles from Port Darwin in North-Australia, and it sometimes finds its way into the rivers of the north-eastern coast. I have also captured it in the upper waters of the Mitchell River, near the Palmer River gold field, and many hundred miles from the mouth of the stream in the Gulf of Carpentaria. It is easily taken with a hook, using a small land-lizard, a prawn, or a moth, as bait. For eating they are highly esteemed, though not amongst the best table fishes. They yield isinglass in the straits, but little is collected, because the fish is

not so common as others, and the air-vessel is very thin and light, that from a large fish when dried weighing little over an ounce. The species is known as the "cock-up" amongst Europeans.

POLYNEMUS INDICUS, Russell. Malay name Ikan kurow. This fish is also found in Australia and extends to India. It attains four feet in length, but is rarely above 20 pounds in weight. A large fish yields about two ounces of rough isinglass. The largest specimens appear to be captured in the mouths of larger rivers. It takes a bait freely (Day). It is frequently found blind, possibly from the friction of mud in river mouths.

SCIÆNOIDES BIAURITUS, Cantor, = *COLLICHTHYS BIAURITUS*, Günther, = *OTOLITHUS BIAURITUS*, Cantor, Catal. p. 57. Malay name Ikan salampai. All these *Sciænoids*, like the *Polynemidæ*, possess air-bladders with a most extraordinary development of appendages arising from each side. In this species 52 branches issue from each side, each branch being bifurcate, and bearing smaller appendages (See Günther, 'On the Study of Fishes,' edit. 1880, p. 144). Seas and estuaries of India to Malaysia and China. Adult specimens three feet long.

OTOLITHUS RUBER, Bl. and Schn. Malay name Jarang gigi. This species, though not esteemed much by Europeans, is largely consumed by the natives from June to August, when it is plentiful. The isinglass is considered very good, of almost the best quality. On each side of the air-vessel are 34 processes, the first four or five of which divide in four branches, the next in three, the next in two, and the last simple and longer, though all have minor ramifications. It contains about 90 per cent. of isinglass, and will set in jelly with 26 times its weight in water. Seas of India to Malaysia. Attaining two and a half feet in length. It is the commonest form in the Indian seas, especially along the Coromandel coast. It is pretty good for the table, spawning from March to July (Day).

OTOLITHUS MACULATUS, Cuvier. Malay name Jarang gigi. The origin of this Malay name "gigi" or teeth, has reference to the

prominent, strong canine on either side of both lower and upper jaws, which makes the appearance of the mouth both conspicuous and formidable. This species has the same range as the last.

SCIÆNA DIACANTHUS, Lacep. = *JOHNIUS DIACANTHUS*, Cantor, Catal. p. 67. Malay name Ikan tambareh. Seas of India, Malaysia and China. Attaining at least five feet in length. It ascends tidal rivers and estuaries, and is found in the Hooghly as high as Calcutta. A species very similar, is known as 'Jew-fish' in Australia.

LOBOTES SURINAMENSIS, Bloch, = *LOBOTES ERATE*, Cantor, Catal. p. 80. Dr. Günther (Catal. Vol. I. p. 338) says this fish is found on the Atlantic coasts of America from New York to Surinam, Caribbean Sea, Ceylon, Bay of Bengal, Straits of Java, Sunda, Molucca and China Seas; and I obtained it in two places in the Philippines, on the coasts of Luzon and Negros. It is also on the east coast of Africa and the Indian seas to Malaysia. On the north coast of Borneo, when in H.M.S. 'Pegasus,' we caught one nearly three feet long. It is excellent eating, yielding but little isinglass. The Malay name is Ikan batu, or Rock fish.

ARIUS CÆLATUS, Cuv. and Val. Malay name Ikan doonee or Saludu. This genus has already been referred to, and is easily known by its being a Siluroid with an osseous, or mailed head. The genus is the largest amongst the cat-fishes, being well represented in nearly every tropical country with large rivers. Some of the species are of large size, as much as five feet long. All are well armed with formidable dorsal and pectoral spines. The eggs are mostly hatched in an extraordinary manner, that is, in the mouth and throat of the male fish. When they are captured at this time the stomach is always found to be empty, and in those examined, some of the eggs were in an early stage of development, others nearly hatched, or actually hatched with the yolk bag adherent. The eggs fill the cavity of the mouth and extend far back into the gills. Dr. Cantor mentions three species from which isinglass is derived, *A. truncatus*, *A. militaris*, and *A. arius*. The last-named may possibly be *A. falcarius*, Cuv. and Val.: the other species I have been unable to identify. The only species

I ever saw captured in these regions is the one above-named, but six others are known, mostly of small size. The fish serve as food of inferior quality, and are best when salted. A good deal of isinglass is derived from them, but of a poor kind.

Of all the above fishes *Polynemus indicus* seems to furnish the largest portion of the isinglass. The fish caught are of great size, but mostly when the rivers are low.

A few more facts about isinglass may be mentioned here. What British people know by that name is the beautiful ribbon-isinglass. It is made from the leaf-bladder, which is first softened in the water and rolled out under high pressure into thin leaves, several feet long. These again pass under a cylinder of numerous revolving knives, by which 6,000 of the well-known beautiful transparent fine threads are produced every minute. The Russian Sturgeon isinglass is even further enhanced in value by snow-bleaching, that is, whitened by being buried for a long period in the snow. Pipes, purses, and lumps are fish-maws which have been cleaned but not opened. These are soaked in water for two or three days and the useless parts removed, then it is rolled and cut into various dimensions. It is chiefly used to clarify beer and other alcoholic liquids, for which gelatine cannot be employed because it dissolves in hot water and alcohol, while isinglass merely swells and grows white. This is a good test to distinguish between the two; for what is generally sold as isinglass in shops is only gelatine. The transparent glutinous substance sold in the bazaars as Chinese gelatine, and often mistaken for isinglass, is a vegetable jelly made from rice. Many algals and lichens are also made to serve the purposes of producing gelatinizing substances, such as *Gelidium corneum*,* from which is prepared what is known as 'Japan isinglass.'

* "*Gelidium*, Lam.—A genus of Cryptonemiaceæ (Florideous Algæ), of which one species (*G. corneum*) is very common on British shores. It has a red, pinnated, horny frond, from two to six or eight inches high; very variable in the appearance of its pinnate sub-divisions. Both spores and tetraspores are found on the ramules, the former in favellidia immersed in swollen ramules." Harvey, Marine Algæ.

There are a few more words yet to be said about isinglass, and my apology for saying so much is, that by giving extensive information, I may make these essays of more practical value to Malaysia. It is necessary to know what isinglass is, so that the character of the export may be increased in value, by knowing how to purify it. Isinglass is a word, the clue to whose etymology is found in the Dutch language, where *huizen* means a sturgeon, and *blas* a bladder. The Malays call it *Palongpong ikan*, or *Ari ari ikan*; the Chinese, *U. káu* (Cantor says Loo-pa, but I know not upon what authority). It was known to the ancients, who called it *Ichthyokolla* (ἰχθὺς, a fish, κόλλα, glue). Dioscorides, who is supposed to have lived in the reign of Nero, mentions it under this name. He wrote a work on the *Materia Medica** in which he mentions isinglass. I cannot quote the passage, but I will quote what is said by Pliny in his *Natural History*, which was probably written about the same time. “*Ichthyokolla* is the name given to a fish with a glutinous skin, the glue from which is also known by the same name, and is highly useful for the removal of *epinyctis*. Some persons, however, assert that it is from the stomach of the fish and not the skin (as in the case of Bull Glue), that the *Ichthyokolla* is prepared. That of Pontus is highly esteemed; it is white, free from veins or scales, and dissolves with the greatest rapidity. The proper way to use it is to cut it into small pieces and then let it soak in water or vinegar for a night and day, after which it should be pounded with sea-shore pebbles, to make it melt more easily. It is generally asserted that this substance is good for pains in the head and tetanus.” Bk. 32. Ch. 24-5.

This passage has a double interest, as showing the antiquity of the controversy about the origin of isinglass, and how ancient is the trade in this material from what is now a part of Russia. If the proper nature of the tissues which produce isinglass had been understood, and the fish that produced it were better known, both the Malayan and Indian trade in the article, with a little careful

* Πεδακίου Διοσκορίδου περὶ ὕλης ἱατρικῆς λόγος ε'

European superintendence, would have vastly increased in value. So late as the year 1857 it was not known what tissue produced the isinglass, and consequently what ought to be got rid of and what retained. Care should be taken that the gelatinous portion is not contaminated by the blood or other tissues of the fish, otherwise it acquires a bad smell, and is very difficult to purify.

It should be remembered, therefore, that there are a few tissues which form the several tunics of the air-bladder:—(1) A very fine membrane, which is the epithelial layer; (2) an extremely fine internal one containing crystalline corpuscles, which cause the silvery shining appearance so frequently seen; (3) an outer membrane of fibrous texture, often attaining to considerable thickness. This is the portion which yields the isinglass. (4) Outside this isinglass there is, in many fishes, a layer of muscles.

When the fish from which the isinglass is taken is caught, the air-bladder is cut out and thrown on one side without any care to cleanse or preserve it. It is during this time that it acquires the appearance and smell that deprives it of so much of its value. When Dr. Cantor first had his attention directed to the product, and the demand there was for it in China, he made lengthened inquiries into the best method of improving the trade. He found that the fish which mainly supplied the Malayan isinglass was *Polynemus indicus*, to which reference has already been made. This is the "Suleah fish" of Bengal. It is an exceedingly coarse fish, but when salted and spiced is converted into "Burtah," a piquant relish highly appreciated by Anglo-Indians.

When the air-bladders of the Suleah are dry they are pellucid, but so tough that they will turn the edge of a sharp knife. They are tongue-shaped, and weigh about 12 ounces (?). They have always attached to them many of the albuminous membranes, which, if the isinglass is to be of the best quality, must be removed while they are fresh. They are covered by a thin cobweb of small blood-vessels, which if neglected, stains and spots them with blood, and the whole becomes hard and consolidated together, and putrid in places.

The vascular membrane, therefore, should be peeled off at once, from the outside and inside, for it is found on both. It looks like white satin, and is seen to consist of transverse fibres, though there is an oblique fibre outside. When dry it becomes hard, horny, and translucent. The transverse fibre, of which nine-tenths of its substance consists, is perfectly pure isinglass. The oblique fibre is albuminous, but is easily removed by a little friction when dry.

The Malays and Chinese fishermen take no trouble at all about the sounds; they are usually sold unopened and uncleaned, just as they are taken from the fish. The fine net-work of blood-vessels is hardened and dried upon the surface, and darkened with blood-stains. In this state it requires much soaking to soften it, and this softening and washing often dissolve much of the pure isinglass within. The article becomes thus greatly impoverished and deteriorated.

If the isinglass trade is ever to be made of value in Malaysia, the Chinese and Malay fishermen must be taught to cleanse the sounds at once, and strip them of their membrane, when they should be rinsed with a little fresh water and dried in the sun. The longer they are exposed to dry in the air the better.

The following references to the literature of the subject may be found useful :—

On Isinglass, by THEODORE CANTOR. Proceedings Zool. Soc. London, Vol. VIII., 1839.

Catalogue of Malayan Fishes, by the same author. Journ. Asiatic Soc. Bengal, 1849, Vol. XVIII. (pp. i.-xii., 983-1443). Introduction iii., 2, 28, 59, 60, 62, 63, 65, 68, 70, 72, 74, 81, 170, 256, 258, 259, 261.

CRAWFURD, *Hist. Ind. Archipel.* Vol. III. p. 440. Edinburgh, 1820.

On Isinglass in Polynemus sele, by Dr. J. McCLELLAND. Journ. Asiatic Society of Bengal, Vol. VIII. Calcutta, 1839.

Official Papers on Isinglass, in *Calcutta Journ. of Nat. Hist.* Vol. II., 1842.*

On East India Isinglass in *Calc. Journ. of Nat. Hist.* Vol. III., 1843. (*Polynemus sele*, p. 179, Plate VI.).

On the Production of Indian Isinglass, by DR. J. F. ROYLE. London, 1842.

The Fishes of India, by FRANCIS DAY, F.L.S. London, 1878.

SHARKS' FINS—As in India, there is an extensive fishery of sharks carried on in the Straits of Malacca, but by Chinese. A few Malays also fish for the same purpose off Malacca and some other points on the coast of the peninsula, as well as at Sumatra. In all the islands of the Archipelago, as well as in the Philippines, Siam, Cochin-China, all the Chinese coast right up to Japan, shark-fishery is an extensive industry. Oil may be said to be the first object, and secondly sharks' fins, which are dried and exported to the Chinese ports for soup and for the production of gelatine. They are assorted into black and white fins. The white are the dorsal fins, which are uniformly light-colored on both sides, and are reputed to yield more gelatine than the other. The black are the pectoral, ventral, and anal fins, which realize a lower price. Shark-skin is also exported to a small extent, as it is used by Chinese carpenters and joiners for smoothing and rasping wood. The species preferred are the Ground Sharks, or Shovel-nosed Sharks, which have no teeth of a sharp projecting kind, but obtuse, ridged teeth, which form a kind of pavement on the dentary plate, which has an undulating surface. These fish are very destructive amongst marine crustacea and molluscs, and are said to live in large shoals. Owing to the great injury done by them to the pearl-oysters in Ceylon, it was proposed to close the mud-banks where they fed with stakes to prevent their egress. There are

* Dr. McClelland commenced the "Calcutta Journal of Natural History" in 1841. The work extended to six volumes, which are regarded as very valuable now. In its pages are several papers upon the fishes of India, particularly on the collections made by Dr. Griffith. These fishes are now in the British Museum.

two genera, namely :—*Rhynchobatus* with a broad snout, a semi-circular or elongated outline, rows of large tubercles and spines on the head and trunk, two dorsal fins, the anterior opposite the ventrals: and *Rhinobatus*, with two dorsal fins, the anterior situated far behind the ventrals. There are two species of the first and three species of the second, four of the five common in the Malay waters. I do not know what the Malay name is, but from their habit of hugging the shore and moving slowly along the bottom, the Tamils call them Mannulavi, or Mud-skate. The fins of some of the rays are used, as also of the smaller sharks, and especially species of *Carcharias* or large man-eating sharks, which are called by the Malays Ikan hiyu; they are, however, principally captured for the sake of the oil obtained from the liver. There are about 17 species, the largest of which is *C. tricuspidatus*, Day.

OTHER FOOD FISHES.—Hilsa or Sabti, the Indian mackerel, the Ikan tanggiri of the Malays (*Cybbium commersonii*), makes its appearance in India in July, where it is known to Anglo-Indians as the Seer-fish, attaining to the length of four feet. When of the proper size they are considered the most delicate eating. If small, that is under a foot long, they are dry. From 18 to 30 inches is the best size; above this they become coarse. They can be eaten boiled, baked or fried, but are generally considered very unwholesome. The natives devour them in such quantities, when the shoals come up in July, that it is said to be the cause of fatal epidemics amongst them. There is no special season for them in Malaysia, for they appear in the markets all the year round. They are cured with tamarinds in India, and form a condiment of pungent flavour, called Tamarind-fish, something like red herrings and lemons, which can be obtained at the Hindoo shops in Singapore.

Mango fish or Tupsi (*Polynemus paradiseus*), so named in India from its visiting the rivers annually, to spawn during the mango season. It arrives as soon as the mango is formed on the tree, and disappears at the close of the season, or about the middle of July. This fish is a luxury much sought after by Europeans and

natives, on account of its delicate flavor: indeed it is said to be the most palatable fish known (in India). It is a small fish, not exceeding nine inches in length, yet ten will fetch a rupee at the beginning of the season. They are comparatively rare in Penang and Singapore. I know of no especial Malay name for them.

Mulletts (*Mugil*) are common at certain seasons in the fresh-water rivers. They are called 'Jumpel' by the Malays, and Wong-mi-tsai or Uyu-t'au by the Chinese. No fish are more highly valued by the Chinese in Malaysia, on account of the great quantity of oil they contain; but they are too rich for most Europeans, who in that climate can scarcely ever eat them with safety.

There are many other much-prized table fishes in India, which are either not known or not appreciated in Malaysia, with the exception of the "Bombay Duck," which the Indians call Bummaloh, and the Malays Luli. It belongs to the family of Scopelidæ, and is the *Harpodon nehereus* of ichthyologists. It is highly esteemed as food, whether fresh or salted. But it is best known as a relish for curries called Bombay Duck. In this case the dried fish is parched upon a pan and eaten dry with the curry. It is very palatable, in flavour much like the dried caplins of Newfoundland and Labrador.

The Bombay Duck, before it is salted and dried, is a fish of most voracious habits, gorging itself with its own species, crustacea, or fishes of nearly its own size. So that if the reason why it is called Bombay Duck be buried in mystery, one can explain the irony of fate which assigns its office to the luxurious and overfed Anglo-Indian. Naturalists tell us that it is frequently found, like our own species, with its stomach and jaws distended with prey, so that we hear without surprise that it is very short-lived. It does not live nearly so long as two other species of *Harpodon*, though at certain seasons, as a kind of indemnification for the brevity of its stay, the whole body becomes brilliantly phosphorescent. Gourmets assure us, that for stomachs that can bear its richness, it is a fish of most luscious flavour if eaten immediately after it is

taken. In the Straits of Malacca it is at all times very numerous, but is most common at Bombay. It occurs from Zanzibar to China, in seas and estuaries, but is rather local. Thus it is not very common at Madras, but augments in numbers up the Coromandel coast, being very abundant in the rivers and estuaries of Bengal and Burnmah, and so on to the Straits. It is more rare at Java, and uncommon at Batavia. It attains at least 16 inches in length. The species figured is from Day's "Fishes of India," Vol. II. Plate CXVIII., fig. 1.

In the Maldive Islands the Bonito is prepared in a peculiar way. The fish when caught has the backbone removed, and is laid in the shade, being occasionally sprinkled with sea-water. When softened by incipient decay it is wrapped up very tightly in palm-leaves, and buried in the dry coral sand, when it becomes extremely hard. The condiment thus produced is of a horny consistency and goes by the name of *Cummelmums*. It is grated upon the rice and gives it a flavour like that which parmesan cheese gives to macaroni.

WHALE FISHING.—Malay fishermen as well as the Chinese go in pursuit of the Loma porpoise with great keenness, as the oil to be derived from it is of considerable value. So also is it with the *Pari*, or large Ray, which is found of large size upon the mud-banks. They are secured by harpoons in the usual manner, the porpoise by day and the skate by night.

In this fishery no special appliances amongst the Malays are known except that which comes in the general way of other kinds of fishing, but the '*Tijdschrift voor Nederlandsch-Indie*' for 1849 gives the following account of whale-fishing amongst the Solorese. "Solor is a volcanic island between Flores and Timor with an area of about 80 square miles. Its inhabitants are Bajow Malays or sea-gipsies, besides mountain aborigines with a bad reputation. The inhabitants of the coast are fishermen, and live by capturing a small whale from which they extract the oil.

"These inhabitants of the shore are hardy mariners and fishers, and think nothing of approaching the whale with their little boats,

eight feet long, to attack the unwieldy monster and tow him to the shore. The way in which they capture him is as follows. Each morning all the boats put to sea to search for their prize. When a whale is observed, they make a signal to each other, and immediately every one is prepared for the attack. This takes place in small boats, in which six or eight men with small paddles row sitting. A harpooner stands in front with his harpoon, not of the best kind, which is fastened to the boat with a rattan rope of fifteen or twenty fathoms. On approaching the whale, the harpooner springs on its back, and drives the harpoon, which is fastened to the boat, with all his force into the animal. The whale, on feeling the harpoon, immediately darts away and dives to the bottom, and of course takes the boat with him. The crew remain, swimming until they are taken up by the other boats. The whale is soon obliged to come up, and the boat generally appears with it; the surrounding boats approach it, and make a second, third and fourth boat fast to the first, in order to impede the whale by the heavy drag. Being thus hindered from making rapid progress, other boats are enabled to run alongside the sea monster and to disable him entirely. The beast is still far from dead when they already crowd upon his huge carcass, cutting and chopping; when the animal is really dead, he is towed in triumph to the shore, drawn up and cut to pieces. Every one is ready, women and children assist, and it is a real holiday for them to dispose of such a sea monster. Every one, small and great, runs with the blubber, which they speedily carry to the mountains, to barter it for maize; while they all give themselves up to unusual enjoyment."

"The oil is not boiled out, but the blubber is hung up in the sun to allow it to drop; the train oil running out of it is then caught in vessels; it is of a nauseous odor, but it is nevertheless made use of by the inhabitants. They find much ambergris floating in the sea; they also kill many sharks, dry the fins and gather birds' nests, all which productions are sold to the Bugis traders for the Chinese market. The payment is made in arrack, copper work, parangs, and iron. The last article is wrought by them for the construction of their prahus, which they call "Kora-Kora."

"The village which most applies itself to the whale-fishing is Lamakera, on the north-east part of the island of Solor, and lying within the Strait. It is the largest, most prosperous and most populous. The four other Mahomedan villages are Layayong, Andanara, Lamahala and Trong, which three last are situated on the island Andanara" (p. 66).

OYSTERS.—Oysters, which the Malays call "Teran" and "Siput," (though Siput seems to apply to a shell-fish generally) and which the Chinese name Hao or Hau or Hau-mau-lai, are gathered and sold in the Straits. I have tasted some which the Chinese had brought to Durian Sabatang, Perak, about 40 miles from the mouth of the river, and where the water was only slightly brackish. The shell-fish were of pretty large size, and brown in color, but utterly tasteless. I believe this is true of all the oysters in the Straits of Malacca. Owing to the large quantity of fresh water, the shells are very thin and poor and much affected by the *Polydora* worm (See Dr. Haswell's note on a destructive oyster Parasite in Proc. Linn. Soc. N.S.W. Vol. X., p. 273.)

The Chinese never eat oysters in a raw state, thinking them too cold for the stomach. They fry them with oil and rice flour. I believe they have a method of drying them also. The oysters are taken from their shells and scalded just enough to harden the tissues, and then dried in the sun. But rock-oysters, for some unknown reason, cannot be so preserved. They are grown or cultivated, and the mode of culture is of two kinds, producing the Shihao, or Rock oyster, and Bamboo oysters, Yu-tzu-hao.

Rock-oysters are cultivated thus :—pieces of stone are laid at short intervals, at low tide, on the mud banks or mangrove islands, where oysters have been observed. Localities are chosen where the current is strong, and where the influence of the tide permits the stones to be uncovered for at least three or four hours. When I enquired as to the reason for this, I was told that otherwise the mud would destroy the molluscs. Very shortly after the stones are placed in position they are covered with young oysters, which grow to full size in six months. They are then taken from

the stones and brought to market. They say that there is no particular spawning season, and that the young oysters come out like buds on the outside of the shell, subsequently freeing themselves and getting attached to the stones.

Bamboo oysters or Yu-tzu-hao, are grown as follows:—Bamboo laths about two feet long, one and a half inches wide, and about half an inch thick, are pointed at one end, and split at the other. A thin oyster shell is inserted in each split, as far as it will go without wedging the lath asunder. A large thick oyster shell, with a good round hole bored in the middle, is put over the split ends to keep them together. A number of these laths are planted over the mud flats closely together, making them look, when the tide has uncovered them, like a young vineyard. The strong currents in the tidal estuaries where the laths are always placed, are evidently charged with embryo oysters which get caught in what we may call this young oyster nursery. In about a month these have developed into spat. These laths are then taken out and planted wider apart in more sheltered situations, the bamboos being then a foot or less apart. In less than half a year the oysters have grown to such a size that they completely encrust and cover the bamboos, and the plantation has a most odd appearance. When they are sufficiently grown they are collected and sold on the sticks.

This method of oyster culture is by far the best that I have seen, and it is one of the many instances where Chinese industry and invention have been much in advance of that of Europeans. Oyster culture in our countries is a thing of the most recent origin, while amongst the Chinese it has been practised for centuries. The method here referred to is not as often seen in Malaysia as in China, partly because the Chinese cannot get from the Malays the necessary control of the mangrove swamps.

BALACHAN.—Any description of the fish food of Malaysia would be incomplete without reference to Balachan or Balachong, which corresponds with what is known in India as Gnapee or Nga-pee. In Javanese it is called Trasi: in the northern Philippine islands

Bagong, and in the southern or Visayan dialects Bacalang, which, however, is merely the name of an edible shell-fish. Crawford, in his Dictionary of the Indian Islands, is my authority for the Tagalo name, which however, I have not been able to verify, though the condiment is known and universally used. I should say here that I do not pretend to fix the orthography of the Malay names, the differences depending on the broad or close sound given to the final "a," and the phonetic variation in giving effect to the nasal "n" or "ng" at the end. Many think that the condiment is peculiarly Malayan, but this is not the case, though it is made in its greatest excellence at Malacca. The article is used over a wide area and by many different nations. Its use may be said to extend from India, through Burmah, Malaysia, Sulu, Siam, and Cochin-China. Crawford says that it is probably the condiment known to the Greeks and Romans under the name of '*Garum*,' adding that the latter is the product of a Mediterranean fish. This is a question which will be examined in a note at the end of this paper. It will be sufficient to say now that the *Garum* of the ancients was certainly applied to condiments which were all modifications of the Malay Balachan, and the name seems to be used to express a briny pickle of any kind in which the principal constituents were salt and fish.

In India, the Balachan, there called Nga-pee, is made of prawns, shrimps, or any cheap fish pounded with water into a fluid mass, and the brine not added until it becomes slightly putrid. The best is said to come from Siam, but I think that of Malacca is entitled to a higher reputation. There it is principally made of prawns (Hudang) and shrimps, with pepper, salt, and sea-weed (*Sphærococcus lichenoides*), made into a stiff paste. In Anam there are two kinds, viz.:—Mam, which is a non-fermented pickle, the aspect and smell of which would for ever decide its reputation in European markets; and Mamnuoc, or Water of Mam, a fermented pickle of fish or Balachan, which must come somewhat nearer the Roman *Garum* of ancient renown. In appearance and taste it is as good, or as bad as Japanese Soy. (See note at the end of this paper on *Garum*).

In Sumatra and many other places in the East, the Malays collect certain species of sea-weed such as *Sphaerococcus lichenoides*, *Gelidium corneum*, and *G. spiniforme*. These, well boiled down, form a jelly called, when dry, Agar-agar, which is largely exported to China. There it is used as medicine, and by coiners for glue. These algæ grow abundantly on rocks round many of the islands of the Archipelago, and quantities get washed up on the beach during the south-west monsoon. When gathered, it is first dried in the sun for two or three days, and then all the salt and lime crystals which are encrusted upon it are carefully washed off in three and four rinsings with fresh-water. It is then spread on mats and exposed to the sun until it is bleached. About half an ounce powdered will make a quart of stiff jelly, which, when flavored with spices, lemon and sugar, makes a most palatable as well as nourishing food for invalids.

Gelidium corneum and *G. spiniforme* are used for making a good deal of the confectionery of the Chinese, who call the substance "Yang-tsai." It is found both on the Indian and Malayan coasts, and even as far as China and Japan. The jelly formed by boiling this sea-weed product or crude gélose in water, and allowing the solution to cool, requires a high temperature for fusion, differing in this respect from a jelly made from isinglass, which readily fuses and dissolves in warm water. This character occasions a peculiarity in the taste of culinary jellies made of the new material, inasmuch as they do not dissolve in the mouth like ordinary animal jelly. The jelly of gélose is but little prone to undergo change; so little indeed that sometimes, under the name of "sea-weed jelly" it is exported from Singapore, sweetened, flavoured, and ready for use, and in this state it may be kept for years without deterioration. Of late it has been much used for the purpose of Bacteria culture according to Koch's method.*

Sphaerococcus is one of the genera of the RHODYMENIACEÆ, a family of Florideous sea-weeds of purplish or blood-red colour, with expanded fronds composed of polygonal cells minute and irregularly

* See Dymock's Vegetable Materia Medica of Western India.

packed on the surface. The genus referred to here, has a linear frond, compressed, two-edged, with an obscure mid-rib which is distichously branched.

Gelidium belongs to the family of sea-weeds called CRYPTONE-MIACEÆ, or purplish and rose-red algæ, mostly bundles of threads of gelatinous or cartilaginous consistency, composed wholly or in part of cylindrical cells connected together into filaments. *Gelidium* is horny, and of very dense structure. The frond is pinnate, compressed and narrow.

FISH-POISONS.—From the number of plants which have the name of fish-poisons among all the Malay races, it would seem as if fishing by stupefying the fishes to capture them is a common practice. I have never seen it done in Malaysia, but I believe it is common. In Malay fish-poisons are called *tuba* (pronounced *tooba*), and I found this name applied to ten different species of plants. There may be more in use, but those enumerated are certainly the commonest. It was not always easy to distinguish between a plant that was regarded as a medicine (Obat), and that which was used as above, and the difficulty of communicating in some of the less known dialects rendered it impossible to obtain correct information. The Malays, seeing me collect plants, would frequently volunteer some statement as to the properties of particular species. It was in this way that the poisonous characters were learned, which would otherwise have escaped me, for some of the species at least, are not known to possess such qualities. It may be presumed that it is only in still waters of small dimensions that the process can be adopted. The poison, I believe, is simply thrown into the water, where the infusion is thought to be the cause of the stupefaction. In some of the larger ponds and lakes this can hardly be the case, and possibly the fish are brought under the influence of the drug in consequence of their swallowing small portions of the plant.

Readers need hardly be reminded that this method of fishing was a common one amongst poachers throughout Europe. It is furtively practised perhaps everywhere. One great objection of

course of the practice, is that fish partly or wholly poisoned are exceedingly dangerous as human food, and there are not wanting instances of fatal results from eating them when captured in this fashion.

The following are the plants referred:—

1. *ANAMIRTA COCCULUS*, Wight, Arn. In Malay Tuba-biji, also Tuba-tuni. This is the well-known plant, more familiar to most persons under the name of *Cocculus indicus*, belonging to the natural order MENISPERMACEÆ, and is perhaps the most generally used as a fish-poison, and certainly the most efficacious. It is a climber belonging to the Malayan flora, extending over large trees, with a stout woody stem between two and three inches in diameter with a deeply-cracked, corky, ash-colored bark. It used to be called *Menispermum cocculus* or *Cocculus suberosus*, but as it has stamens combined in a central column and no corolla, it is made into a separate genus called *Anamirta*. Dr. Chistison recommends the medical jurist to familiarize himself with this plant because used as a medicine, it is widely used also for destroying fish, and also by brewers as a substitute for hops,* an adulteration which is prohibited under heavy penalties. What renders it more formidable as a poison is the difficulty of tracing it, for it leaves no marks on the viscera after death, by which it could be detected. The poisonous properties are principally in the fruit, which is a juicy berry, varying in size from a pea to a small cherry. It is sub-globose, notched, dark brown in color, rough and wrinkled. There is a husk which is acrid and bitter, enveloping a thin bivalved white shell, from which arises a central placenta, contracted at the base and divided above into two cells. Between the placenta and the shell is a yellowish, oily, very bitter seed of semilunar form. The poisonous qualities depend on a substance called pycrotoxine,† a white crystalline substance, usually crystallizing in needles, granular or in transparent plates or silky flexible

* So Dr. Chistison says; but more probably to render the beer more intoxicating.

† See Ann. de Chim. LXXX., p. 209; Ann. de Chim. et de Phys. liv. 181; Lancet, Jan. 11, 1851, p. 47.

filaments. It is soluble in 150 parts of water at F. 57° or 25 parts boiling water, and in ether, alcohol, and acetic acid. It is intensely bitter, and has been found to be poisonous to dogs, goats, cows, crocodiles, birds, and some insects. On man its effects are nausea and sickness, with staggering, trembling, tetanic convulsions and insensibility. It is very fatal to fish, roach being killed very easily, but barbel with more difficulty. The barbel is the fish which, of all others when captured by this method, has produced serious results in those who ate it. It is thought that this is because these fish are less affected by the poison, and taking a longer time to die a larger quantity of it is absorbed.* The method of employing the seeds for the capture of fish is probably to throw a handful or more into the water over-night, and in the morning the fish are found lying on the surface stupefied for the most part, and a few dead. This is what is done in England, France, and to my knowledge in Australia.

2. DERRIS ULIGINOSA, Benth. In Malay Tuba-kayu, in the Sundanese kingdom of Java Tuba-awewe. The genus contains about 35 species, most of them belonging to the flora of tropical Asia. Two extend into tropical Africa and Australia. One of these is the species above-mentioned, of which Mr. James Britten, F.L.S., in the Treasury of Botany, states that the stems are used in Zambesi Land as a fish-poison, and act very effectively and speedily. I was informed in Java that it was the bast of the stem which was thrown into the water, and very soon caused the fish to rise stupefied. It is a tall, woody, glabrous climber, and from the specific name affects swampy grounds. Leaflets in the common form five or seven, one and a-half to three inches long, obtusely

* "According to Sprengel," says Pereira (Vol. II., Pt. II., p. 666), "the fruit *Cocculus indicus* was introduced by the Arabians, and was described by Avicenna and Serapion under the name of Maheradsch." In the copy, however, of the Latin translation of Avicenna (Venice, 1564), the word Maheradsch does not occur, but Mahezeheragi or Mahezhera is said to intoxicate fish. Nor can I find it in Serapion. *Anamirta cocculus* is sometimes termed the Levant Nut or *Bacca orientalis*.

acuminate, shining; pod very flat and thin, obtuse at both ends, an inch to an inch and a-half long, the suture bordered by a narrow wing, with one or two seeds. This species is found on all the eastern coasts of Australia as far south as the jungles on the Hastings river. In the Asiatic tropics it is very widely distributed and common.

3. DERRIS FORSTENIANA, Bl. Tuba-perampuan or the woman's fish-poison. I found that in the Moluccas this species has also fish-poisoning qualities attributed to it, though why it is called woman's fish-poison I have been unable to ascertain. It grows in Celebes, in all the Moluccas, Borneo, and less commonly in the Malay Peninsula.

4. ARTANEMA SESAMOIDES, Benth. In Malay Tuba-berebai. This is a small and somewhat ornamental species of a scrophulariaceous plant nearly allied to the Australian *A. fimbriatum*, and resembling the common fox-glove (*Digitalis*) or the sesamum plant. I was not aware that any poisonous qualities were attributed to it, but in south Sumatra the Lampong Malays use it as a fish-poison. They gather the herbaceous stems and throw them overnight into the water in considerable quantity. In the morning most of the fishes of the pool are found floating on the surface.

5. PONGAMIA VOLUBILIS, Z. and M. (*Leguminosæ*). In Sunda named by the natives Tuba-genu. It is a climbing plant very much like *Derris*; in fact it is only separated from that genus and *Lonchocarpus* by the peculiarity of its pods, which are of an oblong form, about two inches long and an inch broad, flat, thick and hard, not winged at the edges, and containing only one thick kidney-shaped seed. In Java there is no plant so much sought after as a fish-poison. The stems, when cut into short lengths and thrown into the water, stupefy the fishes more rapidly than any other fish-poison; sometimes in less than an hour the effects are produced. A closely allied species (*P. glabra*) is extensively diffused throughout southern India, Burmah, Malacca, the Indian Archipelago, S. China, N. Australia, and the Fiji Islands. The seeds produce abundance of oil much used by the poorer classes.

It has a deep yellowish or reddish-brown colour, and is so thick that it solidifies at F. 60°. I believe that this species also possesses in its stem fish-poisoning qualities, but much weaker than the other.

6. *MILLETTIA SERICEA*, W. and Arn. (*Leguminosæ*). In Malay Tuba gatel. Another genus of climbing papilionaceous plants, closed allied to *Wistaria*, with which it is united by von Mueller and others. It is only distinguished from such genera as *Tephrosia*, *Pongamia*, *Robinia*, &c., by minor peculiarities, especially about the seed-pod. It is much sought after as a fish-poison, and by some of the natives is preferred to any other.

7. *MILLETTIA ROSTRATA* (?) Miq. Malay name Tuba-lalur. Another species to which the same fish-poisoning properties are attributed.

8. *HARTIGHSEA ACUMINATA*, Miq. (*Meliaceæ*). This is a somewhat large tree belonging to a genus which has representatives in Australia and New Zealand. In the latter islands its leaves have a bitter taste, and are used as a substitute for hops, or as a tonic. In Malay it is called Tuba-siapa, and on the west coast of Sumatra, at least, is extensively used as a fish-poison, but I do not know what part of the plant is employed.

9. *POLYGONUM BARBATUM*, L. (*Polygonaceæ*). Malay name Jukut-jaran or jarang. This species is common in tropical Asia, Africa and Australia. It is used as a fish-poison in many portions of the Archipelago, and I believe it is the same species which is used by the natives of Australia for the same purpose.

10. *TEPHROSIA* (*Leguminosæ*). A genus which has many fish-poisons amongst its species, for any representative of which I have searched in vain in the Oriental region. In Australia, however, we have a great number of species, about 28. It will assist the comprehension of the previous remarks to mention what is said by Lindley, (Veg. King. 2nd edit. 1847, p. 549.) "Many *Tephrosias* are employed as fish-poisons especially *T. toxicaria*, the young branches of which, with the leaves pounded, and sometimes mixed with quick-lime, are thrown into a pool of some mountain stream,

and have an almost immediate effect. The fish are observed to become stupefied and as it were intoxicated, and to rise to the surface, floating there with their belly upwards, so as to be readily taken by the hand. It has been remarked that the larger fish recover gradually from the effects of the poison, but that the younger fry perish. It has been suggested that the action of the plant on the human system would resemble that of *Digitalis*, and might prove in a climate where that plant does not grow, a desirable substitute."

It may be mentioned in connection with this subject, that the elder Pliny in the 25th book of his Natural History, Ch. LIV., attributes fish-poisoning properties to a plant which has been somewhat doubtfully identified as the *Aristolochia pistolochia* of Linnæus. He says "The fishermen on the coasts of Campania give the round root the name of "Poison of the earth," and I myself have seen them pound it with lime and throw it into the sea. The fishes swam towards it at once with astonishing eagerness and were at once struck dead so as to float on the surface." There are two species of *Aristolochia* in the flora of Malaysia but to neither of them are fish-poisoning properties attributed.

FISH MANURES.—Small fishes and those of an uneatable kind are brought ashore by the fishermen and sold as manure. Chinese are also employed by some of the sugar planters on the coast for the especial purpose of catching fish to be employed as manure. The consequences to the health of the very numerous labourers on these plantations can be easily imagined. Many condemn the practice as a great waste of the food-supplies of the people, but as a rule only those species are employed which are not consumed as food. The following is a list of the species which I have seen principally employed as manure.

1. *AMBASSIS NALUA*, Cuv. and Val. A fish belonging to the perch family, comprising the smallest of that extensive group, some of the species not exceeding an inch in length. They are most abundant on the coasts of the tropical Indo-Pacific, and in the fresh waters belonging to that area. The species are numerous

and very difficult to distinguish, some 30 having been described. Colour very plain, a silvery hue pervading the whole fish (Günther).

2. *APOGON FUCATUS*, Cantor.

3. *A. QUADRIFASCIATUS*, Cuv. and Val.

4. *A. POECILOPTERUS*, Cuv. and Val. All fishes of the percoïd family, representing a more highly developed form of the family than *Ambassis*, although of similarly small size. Their distribution coincides very much with that of *Ambassis*, but they are chiefly marine, very few of their species entering fresh water. They belong to the kind of fishes which from their habit are termed "Coral fishes," being found in the greatest abundance in the neighbourhood of coral reefs, in company with Chaetodonts, Pomacentridæ, and others. Their colours are ornamental and highly diversified, as is generally the case in coral fishes, the majority of the species showing transverse or longitudinal bands or large spots, and numerous other smaller markings which in the dead fish soon disappear. Nearly one hundred species have been described, of which a few only occur in the Atlantic, one extending northwards into the Mediterranean (Günther).

5. *APISTUS CARINATUS*, Bl. & Schn. One of the family of Scorpenidæ; of the genus there are only two species from the Indian Ocean. They are very small fishes, and like all the family exceedingly thorny, but of interest on account of the prolongation of their pectoral fins, by means of which they are said to be enabled to take extraordinary flying leaps out of the water.

6. *MINOUS MONODACTYLUS*, Bl. & Schn. A small fish of anything but prepossessing appearance, with long pre-orbital spines, and a strong sharp spine and three shorter and blunter ones on the operculum. Greyish in color, flesh-colored along the abdomen, fins marked with black, seldom exceeding four or five inches in length.

7. *ECHINEIS NAUCRATES*, L. One of the sucking fish or Remoras, and probably the most common as well as one of the largest; for, though a slender fish, it is not uncommonly three feet

long. The fish is not considered good for food, but it has the highest reputation as a manure, being especially recommended for fruit trees. It is never very numerous, but single individuals occur at all seasons in the Straits of Malacca.

Wild pigs are at all times much attracted into the cane-brakes by the smell of decayed fish, as well as tigers and other wild animals, including the rhinoceros, as some Malays assured me. Their usual diet is fruit, but even ruminants sometimes take to a fish diet. This is no novelty, as the following quotation will show. It is inserted here, not only for its interest and connection with the subject, but because it will be probably new to most readers. It is taken from the 'Barnstable Journal' (Cape Cod, Mass., U.S., America) of Feb. 7th, 1833.

"FEEDING CATTLE ON FISH.—The cattle at Provincetown feed on fish with apparently as good relish as upon the best kinds of fodder. It is said that some cows, kept there several years, will, when grain and fish are placed before them at the same time, prefer the latter, eating the whole of the fish before they touch the grain. Like one of old, we were rather incredulous on this subject, till we had the evidence of ocular demonstration. We have seen the cows at that place boldly enter the surf in pursuit of the offals thrown from the fish boats on the shore, and when obtained, masticate and swallow every part except the hardest bones. A Provincetown cow will dissect the head of a cod with wonderful celerity. She places one foot on a part of it, and with her teeth tears off the skin and gristly parts, and in a few moments nothing is left but the bones."

"The inhabitants of Provincetown are not the only people who feed their cattle upon fish. The natives of the Coromandel coast, as well as in other parts of the East, practise feeding their flocks and herds with fish. Herodotus mentions this. The celebrated traveller Ibn Batuta, who visited Zafar, the most eastern city in Yemen, in the early part of the 14th century, says that the inhabitants of that city carried on a great trade in horses in India, and at that period fed their flocks and herds with fish, a practice

which, he says, he had nowhere else observed." See also Nat. Hist. Fishes of Massachusetts by Dr. J. V. C. Smith, Boston, U.S., 1833. See also Semper's 'Animal Life,' Chap. II., p. 64, and Note 13, p. 414.

THE TRIPANG FISHERY.—Esculent Holothurians are found throughout the whole of the Indian Archipelago, through the Moluccas along the Australian coast, and through most of the warmer parts of the Pacific, in fact in nearly every place where coral reefs are extensively developed. The word tripang is Malay, but there are various names for the same animal in all the islands of the Indian region. In Visayan and Tagalo it is *Talipan*, but another quality is called *Munang*. In Celebes it is called *Siwala* and *Tripang* as well. There are other names, too, used in the trade which are partly corruptions of Spanish, Portuguese, and Chinese, such as *Balate*, *Kikisan*, *Ginseng*, &c. The Chinese call it *Hoi-Sham* and *Hai-Shin*, the white variety *Pak-* or *Peh-Hoi-Sham*, the black *Hak-* or *Heh-Hoi-Sham*, the red *Hung-Hoi-Sham*. As far as my observation extends, the tripang fishery is not extensively followed anywhere near the Straits of Malacca. There is more of it, perhaps, in Borneo and to the north of that island where the coral reefs are very extensive. Tripang does not seem to be abundant apart from coral reefs.

The most extensive employment of Malays in this fishery is off the coast of Australia. Every year at the proper season, that is during the north-west monsoon, a fleet of 200 to 400 prahus leave the different parts of Celebes and some of the Moluccas for the Australian coasts, where they pursue the tripang fishery for some months. It would seem that this annual expedition has gone on from time immemorial, and no doubt, as Flinders remarks, nature has to some extent been modified by the intercourse. Possibly this is the origin of the rice-plant which is found in North Australia, the bean (*Phaseolus*) and the bamboo, besides several Indian weeds and food-plants. Flinders met a party of these fishermen in February, 1802. They were from Macassar, and mustered about 60 prahus. The object of their expedition was tripang, which they obtained by diving in from three to eight

fathoms. These Holothurians were very abundant in Arnheim's Bay where Flinders met the Malays, so that a diver would bring up eight or ten at a time. They were preserved by scalding them for a few minutes in boiling water after splitting them up and depriving them of their intestines. They then smoked or simply dried them in the sun stretched on pieces of bamboo after being pressed between stones. The prahus return in the beginning of the south-east monsoon, that is about the end of February. The chief of the Malay fleet told Flinders that he had been trading to Australia every year for the previous 20 years, and he believed that their fleet was the first which came there, a statement which we have good reason to question. The fishery is practised entirely for the Chinese market. I do not think that the Malays consume the tripang, but, as everyone is aware, it is so much sought after in China, and is an expensive luxury, which leads to a very profitable trade. Crawford remarks, however, that as no mention is made of the article by the early Portuguese and Spanish writers, the trade began with the comparatively modern arrival of the Chinese in the Archipelago.

It is scarcely necessary to do more than mention the fishery here, unless it be to correct several popular errors about the nature of the sea-cucumber as the *Holothuria* is called. In the various descriptions of the trade, perhaps the best is that given by Capt. A. Cheyne to the well-known P. L. Simmonds, author of "Animal Products and their Uses," but it is full of expressions as to the dimensions and parts of the animal which would lead to a total misconception of its nature. Thus it is called a fish, and the ambulacral tube-feet are called teats, and it is said of a sort called Bankolungan, that it is "brown on the back; the belly white, crusted with lime, with a row of teats on each side:" furthermore we are told that it is hard and rigid, and scarcely possesses any power of locomotion, while others are said to be known by exuding a white adhesive substance which sticks to the fingers when handled.

It may be necessary, therefore, to explain that tripangs, bêches-de-mer or sea-cucumbers, belong to the class ECHINODERMATA, and

are the most highly organized members of it; that is to say vermiform animals with a leathery skin in which calcareous granules, plates and spicules are developed. There is no shell like the sea-urchins, and it need not be said there is no back or belly in the ordinary sense of the term. The so-called "teats" are usually distributed in five rows, dividing the body into an equal number of segments, but they may be partly or wholly wanting. They are the ambulacral tube-feet, corresponding with the same organs in star-fish, or in the poriferous zones of sea-urchins. Sometimes these tube-feet are scattered over the whole body, or they are restricted to what, for convenience, is called the ventral surface. There is a long convoluted intestine, a special water-vascular system and a sand canal. The breathing is performed by a respiratory tree or plume of arborescent tubes around the mouth. In the family of Synaptidæ there is no respiratory tree, and the tube-feet are wanting, whilst the skin is furnished with calcareous spicules of various shapes. The Synaptidæ burrow in the mud or sand, and the skin is furnished with anchor-shaped spicules, with a little calcareous disc fastened loosely around the shafts of the anchor. In Chirodotæ the skin has minute calcareous wheels. In the Oncinolabidæ the skin has barbed spicules, and there are tube-feet but no respiratory tree.

It is a matter of regret to me that though I have seen a good deal of tripang fishery in the Moluccas, Philippines, and Australia, and know most of the commercial varieties which will be referred to presently, I am unable to give any details towards their zoological identification. The commoner species collected belong to the genus *Holothuria*. Thus M. Dujardin (Hist. Nat. Zoophy., Echinodermes) gives as the tripang species, *Holothuria edulis*, Lesson; *H. peruviana*, Lesson; *H. ananas*, Q. and G.; but to these must be added probably some of the genera *Müllera*, *Stichopus*, *Psolus*, *Synapta*, and some others. The order is divided into (1) *Apneumona* or sea-slugs, with no respiratory tree, the tube-feet wanting (Synaptidæ) or present (Oncinolabidæ), and (2) *Pneumonifera* with a respiratory tree, such as *Holothuria*, *Thyone*, *Molpadia*, *Psolus*, *Cucumberaria*, &c. The genus *Holothuria* has

been divided into two sub-genera *Thelenota* and *Microthele*. *Holothuria* is in some sort the type of the whole order. It has a cylindrical, more or less elongated body, rounded towards the extremities, tube-feet more numerous on the crawling surface, scattered above and forming raised conical papillæ, mouth surrounded by 20 short tentacles, shield-like, branched at their extremity, forming a double alternating series. All the order have a singular facility for contracting to such an extent as to disgorge the whole of the interior viscera as well as the tentacles. At the end of some months the animal is said to reproduce them. *Synapta* are perhaps the most interesting animals of the group, with their microscopic spicules like anchors with long shanks fastened to little discs and standing out at right angles to the skin, to which they give a characteristic rough and adhesive feeling on being touched. The milk-white sticky exudation is a form of *cnidae* ejection in which a poisoning power for defensive purposes is included as in the sea-anemones.

As already stated, the coral reefs are covered at low water with a great many of these sea-slugs of all sorts of dingy colours, but only a small proportion of them are of use for the Chinese market. They are distinguished on the Australian coast by the names of "Black-fish," "Teat-fish," "Red-fish," "Cotton-fish," and so on. Amongst the Malays in the Moluccas, Borneo, and the Philippines, the same kinds are distinguished by the names of Talipan and Munang, Lolowan, Matan, Sapatos-China, Sapatos-grande, Balate-blanco, Hanginan, Bacolongan and Kih-kih-san. Some of these names I give only on the authority of Capt. Cheyne in the "Technologist," for I never heard them, but I have no doubt they are in use, but with a different orthography.

Bacolongan is a well-known Tagalo and Visayan term for the first quality of balate or tripang. It is 11 to 15 inches long, oval, brown, with a row of tube-feet on each side. It is hard, rigid, does not move about much, and usually keeps to the deeper water, and therefore can only be obtained by diving. I have not been able to find any derivation for the name.

Kih-hih-san denotes a species prized equally with the last. It is more plentiful and is found without diving. The word is Chinese, and denotes anything poor, miserable, spiritless, or helpless, possibly referring to the habits of the animal. It is from half a foot to a foot long, black above, greyish on the crawling surface, with the tube-feet as in the last variety.

Talipan is a deep mahogany-red color, narrow, and sometimes two feet long, found in two or three fathoms of water; upper-surface covered with large conical papillæ. The name is a true Philippine term for a kind of balate.

Munang is a small kind, about eight inches long, quite black and smooth, without tube-feet or tentacles, probably a *Synapta*. The name is generally applied to a shell-fish. The above four kinds are the best qualities of tripang. The inferior sorts are as follows :—

1. Zapatos china, or the Chinese shoe, a Spanish term applied to an oval slug with a wrinkled surface found adhering to the coral.

2. Lolowan, found on various parts of the reef, similar to the last, but narrow. The term is Philippine-Malay, and the meaning given to me is probably expressed by the Latin *circumcissus*.

3. Balate-blanco is oval, white and orange, exuding the adhesive cottony threads, burying itself in the sand and coming out at night, whence they are generally gathered by moonlight.

4. Matan differs only in color from the preceding: grey, white and speckled. The name refers to some supposed peculiarity about the eyes or vision.

5. Hanganas, generally a foot long, grey or green, found on the inner side of reefs; the name is applied also to the noise made by the surf on the edge of the reefs. Very inferior in quality.

The method of curing the tripang varies slightly in different countries. Sun-dried slugs fetch the most in the Chinese market, but as this is a process which requires 20 days and more to complete, while smoking only requires four or five days, the latter is

generally adopted, except by the Malays and Chinese. The methods are very simple: a low bamboo shed thatched with leaves is erected with two tiers of open drying frames. The fish are placed on the lower ones, about three feet above a trench as long as the building, nearly as wide as the frames and two feet deep. This is kept filled with burning wood. The slugs are split up, eviscerated, washed in fresh water, and placed first upon the lower frames, and then upon the upper until they are dry, care being taken not to scorch or cook them. They are stowed away in bags, and great care must be exercised in drying them from time to time in the sun, as damp and mould easily destroy them. The following directions for scalding tripang are taken from Simmonds' "Commercial Products of the Sea," p. 110.

"Bacolongon and Kih-kih-san will require to be boiled about five minutes or more, if the pot is nearly full; they should be well stirred, and should be taken out when thoroughly heated through, by which time they will feel quite hard and elastic. The cut part of the fish, when properly boiled, should be of a blue and amber color. The Talipan and Munang require to be boiled fully ten minutes. The Munang dries very quickly; but the Talipan is very difficult to cure, and often requires two boilings before it will dry. The Zapatos china requires to be boiled about 15 minutes; if properly boiled it will dry very quickly. The Balate blanco and Matan need very little boiling, say three or four minutes, if the pot is nearly full. They should be taken out as soon as they shrink and are thoroughly heated through. The Hanganas should be boiled about 20 minutes. This sort must be very carefully handled when raw, as it will break in pieces if held any time in the hand. It appears to me that there are two ways of boiling *bêche-de-mer* equally good. The first is to take them out when boiled about a minute, or as soon as they shrink and feel hard; the other method is to boil them as before stated; but in boiling either way, the slugs ought, if properly cooked, to dry like a boiled egg immediately on being taken out of the pot."

It is further added that much care is required to prevent broiling or blistering, but too little heat will render it liable to get putrid in

a few hours. The splitting up and evisceration must not be delayed too long or decomposition rapidly sets in: if the fish cannot be attended to at once, they should be kept in warm water, and not exposed to the sun.

ASTERIADÆ, STARFISHES, BRITTLE STARS, &c.—The following list includes all the species identified by me, as well as some which I take from the list of M. Edmund Perrier.†

ASTERIAS TENUISPINA, Lamarck.

CALVASTERIAS ASTERINOIDES, Perrier.

*ACANTHASTER ECHINITES, Gray.

CIBRELLA ORNATA, Perrier.

ECHINASTER ERIDANELLA, Valenc.

E. FALLAX, Müll. and Trosch.

*MITHRODIA CLAVIGERA, Lamarck.

*FROMIA MILLEPORELLA, Lamarck.

F. MONILIS, Valenc.

METRODIRA SUBULATA, Lamarck.

*LINKIA DIPLAX, Müll. and Trosch.

*L. MILIARIS, Linck.

*L. MULTIFORA, Lamarck.

L. PACIFICA, Gray.

L. PAUCIFORIS, von Martens.

L. ROSENBERGI, von Martens.

*SCYTASTER ÆGYPTIACUS, Gray.

S. TUBERCULATUS, Müll. and Trosch.

*S. VARIOLATUS.

OPHIDIASTER PUSILLUS, Müll. and Trosch.

†Nouvelles Archives du Museum d'Histoire Naturelle, Deuxième Série. Tome I., 1878.

*CULCITA NOVÆ-GUINÆ, Müll. and Trosch.

*C. PENTANGULARIS, Gray.

*C. SCHMIDELIANA, Retz.

GONIASTER OBTUSANGULUS, Lamarck.

GONIODISCUS CUSPIDATUS, Lamarck.

G. GRACILIS, Gray.

G. PLEYADELLA, Lamarck.

*G. SEBÆ, Müll. and Trosch.

*GYMNASTERIA CARINIFERA, Lamarck.

G. BISERRATA, von Martens.

*PENTACEROS MURICATUS, Linck.

*P. OBTUSATUS, Lamarck.

P. SUPERBUS, Möbius.

*P. TURRITUS, Linck.

PENTAGONASTER INÆQUALIS, Gray.

*P. SEMILUNATUS, Linck.

STELLASTER BELCHERI, Gray.

*ASTERINA EXIGUA, Lamarck.

*A. GIBBOSA, Pennant.

*A. PENICILLARIS, Lamarck.

*ARCHASTER ANGULATUS, Müll. and Trosch.

*A. TYPICUS, Sars.

ASTROPECTEN JAVANICUS, Müll. and Trosch.

A. POLYACANTHUS, Müll. and Trosch.

*LUIDIA MACULATA, Müll. and Trosch.

*PTERASTER CRIBROSUS, von Martens.

The species marked with an asterisk are common to other regions. The Malayan region, according to M. Perrier, in spite of some secondary differences ought to be considered not only in the matter of the Asteriadæ, but in other departments, as forming one vast region of zoological geography. The most intimate affinities unite the faunas that belong to its different portions, to which, however, he thinks more properly the term *Pacific Region* should be applied.

The Indian species, properly speaking, are so few in number that they may be inserted here for comparison.

ASTERIAS RUBENS, L.

PENTACEROS AFFINIS, Müll. and Trosch.

P. REGULUS, Valenc.

P. REINHARDTII, Lütke.

P. VERRUCOSUS, Müll. and Trosch.

P. WESTERMANNI, Lütke.

DORIGONA LONGIMANA, Perrier.

ASTROPECTEN EURYACANTHUS, Lütke.

M. Perrier says that it is sufficient to cast one's eyes on this list and to compare it with the preceding to see that the Malayan and Indian regions differ completely in starfishes. If the genera are nearly allied, the species are absolutely distinct.

ECHINOIDEA.—Hardly perhaps connected with the fisheries, but still deserving mention, are the Sea-urchins, &c. The Straits of Malacca are essentially the home of the sea-urchin known as *Diadema setosum*, an urchin of great beauty in the water from its spines five and six inches long, straight, stiff and black, like hairpin wire. When the tide is out the ledges of rock are seen to be simply covered with them as closely as they can lie. The natives call them Bulan-babi or round pig, and they regard the formidable spines with much dread. Next in numbers is *Temnopleurus toruematicus*, which was frequently brought up when dredging, together with a *Salmacis*. The following species have also been identified:—

ECHINOIDEA OF THE ORIENTAL REGION.

CIDARIS METULARIA, Blainv.

PHYLLACANTHUS IMPERIALIS, Lamarck.

DIADEMA SETOSUM, A. Agassiz.

ECHINOTHRIX CALAMARIS, Pallas.

E. TURCARUM, Schynr.

COLOBOCENTROTUS ATRATUS, L.

HETEROCENTROTUS MAMMILATUS, Klein.

H. TRIGONARIUS, Lamarck.

ECHINOMETRA LUCUNTER, Leske.

*E. OBLONGA, Bl.

STOMOPNEUSTES VARIOLARIS, Lamarck.

*STRONGYLOCENTROTUS TUBERCULATUS, Lamarck.

TEMNOPLEURUS TOREUMATICUS, Klein.

SALMACIS BICOLOR, Agassiz.

S. DUSSUMIERI, Agassiz.

*S. RARISPINA, Agassiz.

*S. SULCATA, Agassiz.

MESPILIA GLOBULUS, Agassiz.

TRIPNEUSTES ANGULOSUS, Leske, = *Hipponoë variegata*, Gray.

FIBULARIA OVULUM, Pallas.

*F. VOLVA, Agassiz.

CLYPEASTER HUMILIS, Leske.

LAGANUM DEPRESSUM, Lesson.

L. DECAGONALE, Bell, = *Peronella decagonalis*, Agassiz.

L. PERONII, Agassiz.

ARACHNOIDES PLACENTA, L.

ECHINODISCUS BIFORIS, Leske.

E. LÆVIS, Klein.

*LOVENIA ELONGATA, Gray, Celebes; Northern Borneo.

BREYNIA AUSTRALASIÆ, Leach.

ECHINOCARDIUM AUSTRALE, Gray.

BRISSUS CARINATUS, Lamarck.

MATALIA STERNALIS, Lamarck.

*SCHIZASTER VENTRICOSUS, Gray. Locality uncertain, but probably Banguay.

Those specimens marked with an asterisk were collected by the author. The list, no doubt, would be much increased were a special search made.

CRUSTACEA, CORALS, MOLLUSCA, &c.—The crustacea do not form a very important part of the fisheries of Malaysia, but they occupy a considerable place in the natural history of the region. Like the fishes, the species are widespread, though some of their peculiarities are somewhat local. They are not so well known, however, or not so popularly known as other members of the animal kingdom from the difficulty of preserving them. But few collectors have the necessary skill for removing the perishable portions of the animal and leaving only the shell, and thus we do not often find specimens of crustaceans except in educational museums. Even there the collections are defective, and perhaps there is no portion of zoology which makes slower progress.

The great naturalist of the province, George Everard Rumpf, collected in this department of the animal kingdom as in every other, and in his *Thesaurus Imaginum Piscium Testaceorum, etc.*, published in Batavia in 1711, figured a good many crabs, lobsters, crayfish, &c., which are common to Malaysia and the adjoining islands. The engravings are in many cases very well executed, so

as to leave their recognition a matter of no difficulty. The letter-press gives a Latin name as well as the appellations by which most of the species are known in Malay, the local dialect, and Dutch. Many of the references of Linnaeus are to these figures, and thus they serve to fix the names of the species. There appears to have been little change in the Malay nomenclature during the last 180 years.

Perhaps it may be well to remind readers that the class Crustacea is divided into four large sub-classes, and these again into fourteen or fifteen large orders. The sub-class MALACOSTRACA is the one that contains all those singular beings which we distinguish by the names of crabs, lobsters, crayfishes, prawns, shrimps, squillæ, hermit-crabs, &c. Outside this sub-class there is only one species which need occupy our attention, which is in the small sub-class MEROSTOMATA, so-called because the upper ends of their legs are furnished with masticating jaws. There are only two orders in the MEROSTOMATA, one of which is extinct, and the other called XIPHOSURA, because the tail is long and sharp like a sword. The animals which form this order are the king-crabs.

Every one familiar with books of natural history must have seen a representation of the strange animal known as the *Limulus* or king-crab. It is one of those strange organisms which come like spectres from the domain of palæontology suggesting, by the odd combination of claws, nippers, spike and shield, an offensive thing, with all the noisomeness of the spider and the venom of a scorpion. Hugh Miller has made a Romance of Geology out of such beings from the Old Red Sandstone. We don't expect to see them living now-a-days, but this one has strayed to us from remote palæozoic times. It is a survivor that claims relationship with forms belonging to the very morning of animal life. Its structure gives hints of trilobites, and it is an important connecting link with such strange creatures as *Hemiaspis* of the Upper Silurian. There is evidence that at one time there were many other orders, and that MEROSTOMATA was a sub-class which played an important part in the muddy waters of early palæozoic

times. The period is so remote that it makes us wonder to meet with even two survivors, which are all the king-crabs known to be living to the present day. The remarkable variations of the typical structure can be seen by referring to any of the recent works on palæontology, where the forms of *Prestwichia*, *Neolimulus*, and *Bellinurus*, while preserving the likeness, most curiously modify the details.

A *Limulus* shell is divided into three parts; the cephalic, the abdominal, and the sword-like tail. The head is protected above by a semicircular dome-like shield, on the upper part of which are fixed a pair of compound and a pair of simple eyes; below it has six pairs of legs, the first pair bent upwards, each having claws or nippers at the end, with masticating jaws at the base. The abdomen is protected above by a six-sided shield. Below this are six pairs of leaf-like appendages which carry gills and are used for swimming, while the first pair is an operculum which overlaps and protects the rest. To this is appended the long and sword-like tail. The Malay name is Balancar.

King-crabs are by no means uncommon in the Malaysia. I have obtained many specimens from the Malays, the largest being about two feet in length, which came from Cuyo in the Philippine Islands. It is a burrowing animal which delights to thrust its shield under the mud in shallow water. It shovels away the slime on each side of it, using its tail as a fulcrum, while its legs pick up its food in the shape of worms, small crustaceans, and other organisms, which are disinterred by its excavations.*

*Mr. Alexander Agassiz writes as follows to the "Sillimans Journal":—"Mr. C. D. Walcott has called attention to the fact that when collecting fossils he finds large numbers of Trilobites on their back (Ann. Lyc. Nat. Hist., N.Y., Vol. XI., p. 155, 1875. Twenty-eighth Report, N.Y. State Museum, Dec. 1876.) From this he argues that they died in their natural position, and that, when living, they probably swam on their backs. He mentions, in support of his view, the well-known fact that very young *Limulus* and other crustacea frequently swim in that position. I have, for several summers kept young horseshoe crabs in my jars, and have noticed that besides thus often swimming on their backs, they will remain in a

Amongst the MALACOSTRACA I can only pause to consider two orders of the sub-division PODOPTHELMATA, which have a carapace, and their eyes mounted on stalks. These are STOMAPODA and DECAPODA. The former have six or eight pairs of legs, the gills are not enclosed in a cavity, and the shell is comparatively thin. The commonest example of this is the *Squilla nepa* or *Squilla mantis*, an animal which is often seen and taken for food amongst the islands of the Archipelago. It may be easily known by its zebra-like markings, and by the dactyli of the raptorial limbs being armed with six spines. The carapace is usually marked with more or less distinct longitudinal ribs. The long spines at the interior margin of the dactyli are formidable weapons and capable of giving deep wounds; it must therefore be handled with care.

The *Mantisquilla* must not be confounded with the *Pseudosquilla*, which is much smaller, and has no longitudinal ridges on the carapace, while the dactyli of the raptorial limbs are armed with three slender spines including the terminal, which is the longest. The Malays call this Hudang-laut or sea-prawn.

There is another small *Squilla* named *Gonodactylus chiragra*, which is allied to *Pseudosquilla*; but the penultimate joint of the raptorial limbs is not armed with a comb of teeth, and the dactylus is considerably dilated at the base, and is capable of giving a severe wound to those who are inconsiderate enough to meddle with these

similar position for hours perfectly quiet, on the bottom of the jars where they are kept. When they cast their skin it invariably keeps the same attitude on the bottom of the jar. It is not an uncommon thing to find on beaches, where *Limulus* is common, hundreds of skins thrown up and left dry by the tide, the greater part of which are turned on their backs. An additional point to be brought forward to show that the Trilobites probably passed the greater part of their life on the backs, and died in that attitude, is that the young *Limulus* generally feed while turned on their backs; moving at an angle with the bottom, the hind extremity raised, they throw out their feet beyond the anterior edge of the carapace, browsing, as it were upon what they find in their roads, and washing away what they do not need by means of a powerful current produced by the abdominal appendages." *Amer. Jour. Sci.*, January 1878.

little creatures in the water. They are about three or four inches long, and of generally green colour. All the species are widely distributed throughout the oriental region, and are very common on the coral reefs of Australia. There is another species named *Gonodactylus graphurus*, equally widely distributed, but rarer; distinguished by a median keel on the sixth segment and several small prominences on the tail. There are other species besides, which I need not particularise, so let us pass to the other order or DECAPODA, which are so called because they have always ten legs, with a strong large shell, besides having their gills contained in an enclosed chamber.

The DECAPODA are divided into three tribes, viz., the Macrura or long-tailed, the Brachyura or short-tailed, and the Anomura or irregular-tailed. The Macrura include the lobsters, shrimps and prawns, which are very well represented in Malaysia. Most of the prawns have a wide range and extend even to Australia. Thus *Pencus canaliculatus*, which is commonly seen in the markets and of large size, is common on the coast of Australia as well as the south coast of China and Japan, and extends from the Gulf of Suez on the one side to the Loyalty Islands on the other. There are five or six other species which are equally widely distributed. All kinds of prawns are called Hudang by the Malays.

The rivers of the Malay Peninsula and some of the islands have one species at least of freshwater prawn (*Palæmon ornatus*?) and probably another small species known to naturalists as *Leander natator*.

The crabs or short-tailed DECAPODA are well represented in all the waters which wash the Malayan coasts, with some land representatives as well. The Malays call them Ketam or Katam. In the Philippine dialects this becomes Catang, besides similar terms in the cognate dialects, but the spelling is liable to great variation. As articles of food, most of the species are highly valued by the natives. The methods adopted in fishing for them call for no special remark. Crab and lobster traps are used. It is in these seas that that extraordinary Brachyuran, the spinose *Parthenope* (*P. horrida*, L.) occurs. It has a singular and formidable

heart-shaped carapace, which, together with the long ponderous claws are covered with the roughest spines and tubercles. Spinose crabs are rather the rule in this region. When dredging off the Dindings almost every cast of the net brought up numbers of the long-armed and spinose species of *Lambrus*. The little smooth nut-crabs, *Leucosia* and *Myra*, were equally common from about 10 fathoms. I also found more than one species of those long slender-clawed spider-crabs (*Iphis*), with curious projections from the carapace. The spotted crab is also a denizen of these regions, known to naturalists as *Carpilius*, remarkable for the round and smooth carapace with peculiar notches and projections, huge claws and three, four, or five large round red spots. In the Straits of Malacca also occurs the tortoise-crab (*Calappa hepatica*, L.), but it is generally distributed throughout all the oriental region, extending, with *Carpilius*, *Lambrus*, *Myra*, &c., along all the coasts of tropical Australia. Indeed it may be said that with regard to the crustacea, the differences between Australia and Malaysia are not numerous, while the species common to both would make too long a list for insertion here. In the tortoise-crab the carapace is wide, extending over the limbs like a dome, and perfectly covering them, even though the claws are very large and compressed, and has a wide projecting shell on the upper margin. When squatted down, with their limbs securely housed, they are like a box. The name *Calappa* is derived from the Malay word for cocoa-nut, but according to Rumphius the crustacean is also called Cattam-bisa or the poisoned-crab.

It would be useless to attempt to enumerate all the different species of crabs that are found in this region. I may mention Ketam-batu or stone-crab, a large species, Ketam-ayam, *Neptunus pelagicus*, which is the common edible crab of Sydney in Australia, *Ranina dentata* or Ketam-Radoc, the toothed frog-crab which is said to travel on land and clamber over the roofs of houses. This last-named is one of the very grotesque forms, with a carapace like a scoop, and disproportionately small abdomen: rough, white, spiny projections on the edge of the shell looking like artificial teeth complete the curious make-up.

On the rocks of the coast we have abundance of those half land and half sea crabs, called painted crabs (*Grapsus strigosus*, or *variegatus*), which are found in all warm parts of the globe. The painted crab is seen on the very margin of the water, advancing with the receding tide or retreating before the water as it advances. Crowds of them may be observed standing on tiptoe on rocks, where the spray is dashing, while their somewhat small claws are incessantly going between the ground and their mouths. I think they live on the slimy *Confervæ* and small algæ, which form the green mossy coating or water marks on rocks only partially covered by the tides. They are wary creatures which keep a sharp lookout from their stalked eyes. Make any noise that you will and they go on with their feeding unconcerned; but make a slight movement and they are off with wonderful swiftness, making jumps and performing inexplicable feats of climbing and dashing in amongst the spray, as though reckless of life or limb. I imagine that it is the self-same species that we have on all the coasts of tropical Australia. It is not eaten anywhere: I know not why. Some crabs are said to be poisonous; such as the *Carpilius* and *Calappa*.

The fighting-crab or calling-crab, as the Malays have it (*Gelasimus vocans*, in Malay Ketam-pangil), is found on the mangrove and muddy flats. All who are familiar with eastern tropics must know these creatures. When the tide has receded, the mud flats are seen to be riddled with their burrows, while the owners speckle the ground with moving variegations. They have one huge yellow claw as big as their whole body, so oddly disproportionate to their size indeed, as to look as if borrowed from some larger species. I believe it has been given for digging purposes alone, and if the crab is watched it will be seen to be a very effective implement. When the animal has strutted about and fed itself, and the tide is returning, it goes to the edge of its burrow, and with one sweep of its great claw puts a goodly heap of mud on the brink, and then quietly subsiding down into the pit draws the heap of mud after it, and its place is known no more. The term calling-crab is probably from a sharp clicking noise they make, very like the cracking of a whip.

Ocypoda ceratophthalma, Pallas, and *O. cordimana*, Desmarest, are the names of two racing crabs, common in the Indian region, and known by the surprising rapidity with which they run sideways over the sands, or burrow into them to escape detection. Their long eye-stalks, grey colour, and swiftness of foot must serve for their identification anywhere.

When out exploring in Perak I found, at a height of 4000 ft. above the sea, a small, smooth green crab which probably belonged to the genus *Geocarcinus*. These animals are found in all tropical countries, living at some distance from the sea in burrows which they excavate near marshes or in moist forests. It is said that they feed at night, and moreover that they migrate at certain seasons to the sea to deposit their eggs; but accurate observation is needed on these points.

Amongst the long-tailed crustaceans the rock-lobster has not been mentioned, the *Palinurus fasciatus*, Fabr., of naturalists and Hudang-ondor of the Malays. When off Malacca in October, 1883, I had the good fortune to catch, with a hook and line, one of the largest specimens of this rock-lobster that I have seen. The antennæ were enormous, being over six feet long, while the variegated white and black carapace and showy spines made it one of the handsomest species of the genus. Many persons call this a crayfish, but as that term is applied to the freshwater lobsters it had better be restricted to them. It will be remembered, of course, that *Palinurus* has no large claw like the common lobster. The curious long-tailed lobster, *Ibacus antarcticus*, L., known by the wide, flat carapace, and the large and leaf-like outer antennæ and partly flexible tail-pieces, is found from India to Australia, but is not common. It is not confined to the tropics.

It need hardly be said that hermit-crabs abound on the Malaysian coast, as they do in all tropical seas, including the genera *Pagurus*, *Eupagurus*, *Diogenes*, *Calcinus*, *Cenobita* and others. Any one who has been in the tropics need not be told how exceedingly numerous the hermit-crabs are. Such a thing as an empty sea-shell is what is rarely seen. They are filled with these adventurous lodgers, but for the most part so carefully concealed that

some little skill in observation is required for their detection. Where it is possible, the hermit-crab having withdrawn within the spiral chamber of his borrowed house, closes the aperture with the larger of its claws. In the case of the shells belonging to the genus *Nerita*, the resemblance of the claw to the natural operculum is very close, but it will not bear inspection. A very slight attention reveals the lobster claw. As a matter of fact the animal tries the deception sometimes on shells that have not a shelly operculum. Many naturalists speak of the deception as if it was the result of some reasoning power on the part of the animal, but an attentive consideration of the facts would, I think, show that the animal acts in a blind manner in the matter. In a large number of cases there is no imitation of the operculum. *Nerita* seems to be the genus the shape of whose aperture especially favors it. It is also one of the commonest shells found on the beach and among the mangroves.

The soft unsymmetrical abdomen, always without calcareous plates and often with ventral appendages, is very liable to injury without some very hard protecting covering such as a molluscan shell. It seems to accommodate itself in shape to the windings of the spiral chamber, so as to hold with such a tenacious grip, that the animal can seldom be extracted without injury. Sometimes the hermit-crabs will rush impetuously out of the shells through fright, but as a rule they hide themselves as best they may, keeping perfectly quiet until an opportunity of escape seems to offer. A friend of mine once, attracted by the beauty and variety of the shells on the beach at Tanjong-kling near Malacca, collected a number of these spoils of ocean for the adornment of his room. He left them on his dressing-table at the bungalow, and when he returned after dinner they were gone. All night long his slumbers were disturbed as if a game of marbles were being played upon the floor. He made sure it was a serpent in his room, and dreaded to expose his feet to the danger of being bitten by getting out to see. It was the hermit-crabs cruising about and dragging their shells along the boards. In the morning they were found scattered all over the floor, having travelled fast and far during the night.

Finally, some mention is due to the *Birgus latro* or cocoa-nut land-crabs, which, if mentioned last, are certainly not the least amongst the crustacea. The Malays call them Ketam-calappa or cocoa-nut crab, and Ketam-canary and Ketam-mulana. In Amboyna in the days of Rumphius they were called Katattut and Atattut, I presume in the Alfura dialect. The animals are not common anywhere, and as they are very destructive to cocoa-nuts they are vigorously sought after, more particularly as they are excellent eating. Amboyna and some of the Philippine Islands are the places where they seem to be best known. They are nocturnal in their habits, and live in burrows under-ground, sometimes at a little distance from the sea, and 300 feet and more above it. As to how the cocoa-nuts are procured there are conflicting accounts. Some say that the cocoa-nut tree is climbed, which seems difficult to believe. The popular account about the animal scooping out the nut through the germinal eye is absurd. The eye is beaten out, and the shell broken away by the huge claws. The husk is first completely stripped off, and the shell nipped into pieces by the powerful pincers. A great deal of oil is at certain seasons got from the tail.

When in Borneo at Labuan, I saw large tracts of the low marshy ground dug up into heaps, which the natives informed me was done by land-crabs. I tried to get specimens but was unsuccessful.

The following is a list of crustacea collected at Singapore by Surgeon-Major Archer, supplemented by a few species found by myself:—

PODOPHTHALMIA.

BRACHYURA.

OXYRYNCHA.

MAIIDÆ.

MAIA MIERSII, Walker (n.sp.)

ONCINOPUS NEPTUNUS, Adams and White.

DOCLEA MURICATA, Herbst.

- D. OVIS, Herbst.
D. TETRAPTERA, Walker (n.sp.)
EGERIA LONGIPES, Herbst.
HYASTENUS ORYX, A. M.-Edwards.
H. PLANASIUS, Adams and White.
H. DIACANTHUS, De Haan.
SCHIZOPHRYS ASPERA, M.-Edwards.
MICIPPA MASCARENICA, Kossman.
M. CURTISPINA, Haswell.

PARTHENOPIDÆ.

- GONATONOTUS PENTAGONUS, Adams and White.
CERATOCARCINUS DILATATUS, A. M.-Edwards.
LAMBRUS LACINIATUS, De Haan.
L. LONGISPINUS, Miers.
L. LONGIMANUS, Leach.
L. PRENSOR, Herbst.
CRYPTOPODIA FORNICATA, Fabr.

CYCLOMETOPA.

CANCRIDÆ.

- ATERGATUS INTEGERRIMUS, Lamarck.
A. FLORIDUS, Rumph.
ACTÆA SPONGIOSA, Dana.
A. AUREOLATA, Dana, var.
A. RUEPPELLII, Krauss.
XANTHO SCABERRIMUS, Walker (n.sp.)
LOPHOZOZYMUS EPHELITICUS, L.

ERIPHIIDÆ.

- PILUMNUS VESPERTILIO, Fabr.
P. DE HAANII, Miers.

P. LABYRINTHICUS, Miers.

ACTUMNUS SETIFER, De Haan.

ERIPHIA LÆVIMANA, Latr., var. *SMITHII*, McLeay.

TRAPEZIA CYMODOCE, Herbst.

POLYCREMNUS OCHTODES, Herbst.

CARCINOPLACIDÆ.

HETEROPLAX DENTATUS, Stimpson.

RHIZOPIDÆ.

TYPHLOCARCINUS VILLOSUS, Stimpson.

CERATOPLEX CILIATUS, Stimpson.

GALENE BISPINOSUS, Herbst.

PORTUNIDÆ.

NEPTUNUS PELAGICUS, L.

GONIOSOMA NATATOR, Herbst.

G. CRUCIFERA, Fabr.

G. INÆQUALE, Walker (n.sp.)

ACHELOUS WHITEI, A. M.-Edwards.

THALAMITA SIMA, M.-Edwards.

CAPHYRA ARCHERI, Walker (n.sp.)

CATOMETOPA.

MACROPTHALMIDÆ.

GELASIMUS VOCANS, L.

PODOPHTHALMUS VIGIL, Fabr.

OCYPODA CERATOPHTHALMA, Pallas.

GRAPSIDÆ.

GRAPSUS STRIGOSUS, Latreille.

PACHYGRAPSUS TRANSVERSUS, Gibbes.

SESARMA BOCOURTI, A. M.-Edwards.

PINNOTHERIDÆ.

PINNOTHERES OBESUS, Dana.

DOTILLA MYCTIROIDES, M.-Edwards.

OXYSTOMATA.

LEUCOSIIDÆ.

LEUCOSIA CRANIOLARIS, L.

L. WHITEI, Bell.

L. MARMOREA, Bell.

L. HÆMATOSTICTA, Adams and White.

MYRA AFFINIS, Bell.

M. CARINATA, Bell.

M. AUSTRALIS, Haswell.

PHILYRA PISUM, De Haan.

NURSIA PLICATA, Herbst.

OREOPHORUS RETICULATUS, Adams and White.

TLOS MURIGER, Adams and White.

ARCANIA 11-SPINOSA, Adams and White = A. PULCHERRIMA,
Haswell.

ONYCHOMORPHA LAMELLIGERA, Stimpson.

MATUTIDÆ.

MATUTA VICTRIX, Fabr.

M. LUNARIS, Herbst.

M. BANKSII, Leach.

CALAPPIDÆ.

CALAPPA LOPHOS (Herbst), var. γ , De Haan.

DORIPPIDÆ.

DORIPPE SIMA, M.-Edwards.

D. ASTUTA, Fabr. (young specimen).

ANOMURA.

DROMIIDÆ.

DROMIA VULGARIS, M.-Edwards.

D. RUMPHII (?) Fabr. (young specimen).

CONCHÆCETES CONCHIFERA, Haswell.

PORCELLANIDÆ.

PETROLISTHES DENTATA, M.-Edwards.

P. CORALLICOLA, Haswell, var.

POLYONYX OBESULUS, White.

P. COMETES, Walker (n.sp.)

PORCELLANELLA PICTA, Stimpson.

PAGURIDÆ.

UDIOGENES MILES, Fabr.

CLIBANARIUS VULGARIS, Herbst.

CENOBITA PERLATA, M.-Edwards.

UDIOGENES AVARUS, Heller.

GALATHEIDÆ.

GALATHEA ELEGANS, Adams and White.

MACRURA.

GEBIIDÆ.

GEBIOPSIS DARWINII, Miers.

THALASSINIDÆ.

THALASSINA ANOMALA, Herbst.

SCYLLARIDÆ.

THENUS ORIENTALIS, Herbst.

PALINURIDÆ.

PALINURUS ORNATUS, Fabr.

ALPHEIDÆ.

ALPHEUS COMATULARUM, Haswell.

A. MINUS, Dana.

A. EDWARDSII, Audouin.

PALÆMONIDÆ.

PALÆMON CARCINUS, Fabr.

PENÆIDÆ.

PENÆUS MONODON (Fabr.), var. CARINATUS, Dana.

P. VELUTINUS, Dana.

P. AFFINIS, M.-Edwards.

ACETES INDICUS, M.-Edwards.

STOMATOPODA.

SQUILLA NEPA, Fabr.

GONODACTYLUS CHIRAGRA, Fabr.

MOLLUSCAN FISHERY.—Though I propose in another place to deal with the mollusca of the Malaysian region, this account of the zoology would be imperfect without some reference to the trade in shells for ornamental purposes. Those who have been to Singapore in one of the mail-boats will not be likely to forget the crowds of Sampans or native boats, freighted with most beautiful corals and brightly coloured shells. They are arranged in such a manner as to be really very attractive, and probably no seas can surpass this region in the beauty, variety of form, and brilliancy of colour of its corals and shells. For a few dollars, a boat-load of these curiosities may be obtained. The species principally offered are four or five species of scorpion-shells (*Pteroceros lambis*, *chiragra*, and *scorpius*); the large conch shell (*Triton maculatus*), the thorny wood-cock (*Murex tenuispina*), besides *Murex haustellum*, *palma-rosæ*, *adustus*, *saxatilis*, and others. About ten species of cone are commonly offered, all brightly coloured, and notably the marbled cone (*Conus marmoreus*). *Voluta vespertilio*, *Mitra episcopalis*, and *M. vulpecula* are always offered in abundance

with large and very finely shaped or colored specimens of *Fusus*, *Pleurotoma (babylonica)*, *Melo*, *Ranella*, *Terebra* or augur-shell, and *Turbinella cornigera*. The finely enamelled and brilliant cowries and olives are, of course, numerous represented, notably *Cypræa tigris*, *histris*, *argus*, (rarely) *arabica*, *mappa*, *annulus* (very common), and *Ovulum ovum*. The olives are confined to one or two species, such as *O. irisans* and *O. oryza*, but they are served out in bushels in beautiful preservation, with abundance of *Naticas* and *Neritas*; *Nerita costata*, *atropurpurea*, *polita* and *albicilla*. *Trochus niloticus*, and *Turbo marmoratus* are also common, and, together with the nautilus shell, often deprived of the outer shelly coat, which is chipped off with ruthless vandalism to display the nacreous interior. The bivalve shells are well represented by the clams, *Hippopus maculatus* and *Tridacna squamosa*, always abundant and of large size; the beautiful *Pecten pleuronectes* (both the thin red and white porcelain varieties) is common, with *Placuna placenta* which is used instead of glass in the window-frames in the Philippines, Macao, &c.; and the clumsy-looking *P. sella* in all the glories of its gold and purple nacre. Curious pinnæ, mussels, cardiums and pearl oysters must complete this list, which has only partly enumerated the conchological splendors of the Malayan region.

CORALS.—A great number and variety of corals are exposed for sale along with the shells, including, of course, a large proportion of branching Madreporæ, such as *M. secunda*, *abrotinoides*, *nobilis*, *echinata*, *acervata*, *arbuscula* or *rosaria*, *appersa*, *conigera*, *brachiata*, *plantaginea*, *subulata*, *spicifera*, *securis*, besides a good many encrusting species. The *Fungia* or mushroom corals are very abundant, including *F. patella*, *dancæ*, and *echinata*, with *Herpetolitha limax* and *Polyphyllia pelvis*. The large cup-shaped *Turbinarias* are abundant, with the usual cespitose tufts of *Seriatopora*, *Pocillopora*, the thorny *Mussas*, besides numerous brain-corals, *Favia*, *Symphyllia*, *Astræa*, and other meandroid LITHOPHYLLACÆA. *Galaxea astræata* is plentiful; and one day, when fishing off the Dindings, my line became entangled with a

large specimen of *Dendrophyllia nigrescens*, which is stated to be a Fiji species. At one time it was my intention to form a list of the species which might be considered peculiar to Singapore, but I soon found that there is absolutely no appreciable difference between the coral faunas of Singapore, the great Australian Barrier Reef, the Fiji Islands, and the islands of the Pacific. There may be local species, but these are only few in number. A good number of Malays are employed in gathering corals from the reefs, which they bleach and sell, mostly to the passengers on the mail boats.

PEARL SHELL AND PEARL FISHERIES.—The eastern region has always been famous for its pearl fisheries; but more in the direction of the Aru Islands, New Guinea, and so on towards Australia, and the Sooloo Archipelago than the Indian Archipelago proper. Mother-of-pearl oysters have always been a valuable export from the Philippine Islands. Speaking of the Aru Islands, Mr. Earl says ("Jour. Ind. Archip." Vol. IV., p. 490): "But the great sources of wealth are the pearl and tripang banks which lie on the eastern side of the group, and are often several miles in width, being intersected by deep channels, some of which will admit vessels of burthen. The tripang or sea-slug is of several varieties. The greater portion is caught in shallow water, where it can be picked up off the bank without diving. The pearl oysters are of two varieties. 1st. The large oyster, with a strong thick shell, from six to eight inches in diameter, which furnishes the mother-o'-pearl shell of commerce. These are obtained by diving, and are highly prized, being nearly always in demand at Singapore for the European and Chinese markets. This oyster produces few real pearls, but certain gnarled, semi-transparent excrescences are occasionally found on the surface of the inner shell, which are so highly esteemed by the Chinese that they often attain enormous prices. The other description is the small semi-transparent pearl oyster, having the inner surface of the shell of a bluish colour (probably a *Unio*). The shell is of small value as an article of commerce, but the oyster itself often

contains pearls which, although individually of no great value, are so numerous as amply to repay the labour of collection. Pearls of sufficient size to undergo the process of boring are sometimes found, but the greater portion are what go by the name of sea-pearls, and are only marketable in China, where they are much valued when pounded and mixed with some liquid, as a medicine."

The Sooloo Archipelago has, for some hundreds of years, enjoyed a reputation for its pearl-fisheries. Barbosa, who wrote in Lisbon in 1516, referring to a time about five years earlier, says "Leaving Cipit to the east we saw to the west two islands called Zolo and Taghima. Near these islands grow pearls. The two pearls of the King of Borneo, of which I have spoken, were found here." (*Primo Viaggio*, p. 125).

When in Sulu in November, 1885, I had an opportunity of seeing something of the pearl-fisheries. The principal dealers are the Chinese, who sometimes have some fine specimens to offer for sale. All that I saw were beautifully round, and of fine golden colour, for which a fair price was asked. The island may be said to be an emporium for pearl-shells and pearls. The stores where they were offered for sale were those of general dealers, a combination of grocers and provision merchants, while seemingly ready to buy and sell everything like all Chinese shopkeepers, who are traders to the manner born. They had large stocks of shell, which they were ready to retail by weight at a price which would make a pair cost about a dollar and a half. The pearl oysters of this region may be known by the peculiar rich golden color of the nacre. The island is used as a convict station by the Spaniards for Indians and Mestizos. Many of these gain a livelihood by painting or carving upon them rough representations of the Last Supper, the Crucifixion, and other Scriptural subjects. As the waters round the island are unusually deep, the fishery requires divers of astonishing powers of endurance. I will not venture to repeat the stories that I have heard on this subject. A diver will frequently bring up about 30lb. of shell. I need not describe the methods adopted, which are well known. From the Island of Labuan, also, pearls are sometimes sent to Singapore to the value

of about £11,000 per annum ; but latterly the trade has much declined. The price of pearls varies very much. The quotations available give for a good round white pearl of three grains about 17s. to £1, and one of thirty grains from £85 to £100.

OTHER SHELLS.—The trade in shells as curios has already been referred to, but there is still a small commerce in shells for manufacturing and useful purposes, such as—(1) Nacreous shells for buttons, brooches, and similar useful articles ; (2) iridescent shells for inlaying work ; (3) small shells for shell-flowers, basket-work, ladies' ornaments ; (4) cameos ; (5) domestic articles.

For some of these uses the Straits Settlements could secure an extensive trade as far as nacreous shells are concerned, and some of the smaller ornamental kinds, particularly the porcellaneous cowries. Quite recently a highly fashionable ornament for ladies has been manufactured in France from the beautiful scarlet and black *Strombus luhuanus*, which is one of the commonest shells in the Archipelago, and might be shipped therefrom by tons. Cameo shells of a fine character might be found in the very common *Murex saxatilis*. A valuable export might also be obtained from the opercula of certain Turbos (used for studs, sleeve-links, &c.), and in the larger clam-shells (*Tridacna gigas*, and *squamosa*, *Hippopus maculatus*, &c.), and the common large cones (*Conus litteratus* and *millepunctatus*).

CUTTLE-FISH.—Cuttle-fish are consumed in the Malayan region as amongst all the Easterns where they can be caught ; but they do not appear to be nearly so abundant as on the Chinese and Japanese coasts. The Chinese fishermen in the Straits use for their capture a set of hooks like the arms of a chandelier, made fast round a piece of wood with a sinker to which the line is fastened. The hooks are long and very sharp, but without barbs. The bait, which is generally a crustacean, is fastened to the centre-piece, and the Cephalopods are taken below by the hooks as they bite at it. A cuttle-fish boat, for there are special craft for the fishery, is one of the most interesting sights which the fishing industry affords. The capture is effected by means of a net, at

night time, the fish being attracted by lights and fires. They are lightly salted, pressed and sun-dried. All kinds are eaten, but the best is the little *Sepiola*, which is really a dainty morsel when properly cooked.

NOTE ON THE AERIAL RESPIRATION OF FISHES. — Professor Jobert of Dijon, who was lately engaged in making some zoological investigations in Brazil, at the instance of the Emperor Don Pedro, has ascertained some exceedingly remarkable facts in connection with the respiration of certain fishes. A Siluroid fish which inhabits the neighbourhood of Rio de Janeiro (*Callichthys asper*) and is noted for its power of living a long time out of the water, was found by him to swallow small portions of air, from which it partly absorbs the oxygen by the agency of the walls of the intestinal canal; the carbonic acid formed and the unabsorbed nitrogen passing away by the anal aperture. On examining the structure of the intestine, Professor Jobert found its inner surface bearing a multitude of filiform appendages arranged in tufts and composed essentially of blood-vessels.

A somewhat analogous case was observed in several other fishes inhabiting the valley of the Amazon. They live in stagnant water the temperature of which often exceeds 104° F.; but this does not appear to be sufficient to support their respiration, and they are obliged to come frequently to the surface for a supply of air. Sometimes also, the water in which they have been living is dried up, when they are seen making considerable journeys by land in search of more favourable localities, crawling on the ground by means of their pectoral fins. Some of these are species of *Callichthys*, and like the *C. asper* of Rio de Janeiro, they possess a double respiration—respiring the air contained in the water surrounding them by means of their gills, and also the atmospheric air which they swallow, and which passes through their intestine. The escape of the exhausted air from the anal aperture of these fishes is said to produce a constant bubbling in the water which they inhabit, and M. Jobert's investigations, though imperfect, sufficed to convince him that the air evacuated contained much

carbonic acid, and less oxygen than atmospheric air. The vascular tufts clothing the wall of the intestine originate from adjacent veins in the same way as the afferent vessels of a lung. Species of *Doras* and *Hypostomus* inhabiting the Upper Amazon, respire air in the same way as the *Callichthys*, but in the *Hypostomi* the used air is returned towards the mouth, and escapes by that orifice or by the branchial apertures.

In *Sudis gigas* and some species of *Erythrinus* aerial respiration takes place by the agency of the swimming-bladder, which in the latter, has long been known to communicate with the outer world through the cesophagus, and to be furnished internally with numerous cells formed by membranous folds. Prof. Jobert finds that the walls of the swimming-bladder, including all these folds, are richly provided with blood-vessels, mostly originating from the venous system, and that it is thus converted into a true lung, by the possession of which the fishes are enabled to live for a long time out of water. Of the reality of this respiration Prof. Jobert convinced himself experimentally by obstructing the air-duct leading to the bladder; the fish soon died by suffocation. These observations are particularly interesting as establishing further bonds between the true fishes, the *Lepidosiren*, and the perenni-branchiate *Batrachians*, which possess at the same time branchiæ and true lungs. (*Comptes Rendus*, Ap. 15, 1878).

NOTE ON THE GARUM OF THE ANCIENTS.—Crawford appears to have quoted second-hand, so it may be of interest to show what the ancients said on the matter. There is a good deal explained by the elder Pliny in Book XXXI., chapter 44, and a doubtful reference in Horace, 8th Satire, line 46. The following is what Pliny says:—

“Another liquor, too, of a very exquisite nature is that known as *Garum*. It is prepared from the intestines of fish and other portions of offal, macerated in salt, and in fact it is the product of their putrefaction. *Garum* was formerly preserved from a fish called ‘*Garos*,’ by the Greeks.”

This word "Garos" occurs again in Book XXXII., chap. 53, where Pliny gives the names of all the animals that exist in the sea, 176 in number. Like the majority of the names enumerated there, Garos has not been identified. By a strange coincidence the Malay word for salt at the present day is Garam, and it is just possible that we may trace in this an Indian origin for the condiment. Just as our word indigo, from the Latin *Indicum*, asserts the Indian origin of the pigment brought from the East amongst the Greeks and Romans; and the Sanscrit names for elephant, ivory, monkey, and peacock amongst the Hebrews, tell us of the intercourse between the Hindoos and Jews in ancient times, and the country from which these animals were derived; so the word Garum in Latin and Garos in Greek traces the origin of this classico-oriental condiment. Now the Sanscrit word for salt is "Sara," and this word is represented in the Malay "Garam," the Roman "Garum," and the Greek "Garos," and even the Javanese "Trasi." For the natives of South Celebes use for salt the word "Gara" and "Sela." In Sulu the term used is "Gasi;" in Buru (North Moluccas), "Sasi;" in Gilolo, "Gasi;" in Amboyna, "Tasi;" in some small islands south-east of the Moluccas (Matabello), "Sira."

But let us go on with Pliny, and finish with what he says about Balachan. "At the present day, however, the most esteemed kind of Garum is that prepared from the Scomber in the fisheries of Carthago Spartasia; it is known as 'Garum of the allies,' and for a couple of congii we have to pay but little less than one thousand sesterces. Indeed there is no liquid hardly, with the exception of the unguents, that has sold at higher prices of late; so much so, that the nations which produce it, have become quite ennobled thereby. There are fisheries too of the Scomber on the coasts of Mauretania, and at Carteia on Boetica, near the Straits, which lie at the entrance to the ocean; this being the only use that is made of the fish. For the production of Garum, Clazomenæ is also famed, Pompeii too, and Leptis; while for their Muria, Antipolis, Thurii, and of late Dalmatia, enjoy a high reputation.

In Chapter XXXIV. in the same book, the following passage occurs : "Alex,"* which is the refuse of Garum, properly consists of the dregs of it when strained ; but of late they have begun to prepare it separately, from a small fish that is otherwise good for nothing, the Apua of the Latins or Aplaïsæ of the Greeks, so called from the fact of its being engendered from rain. The people of *Forum Julii* (the present Frejus in the south of France) make their garum from a fish to which they give the name of Supus. In process of time Alex has become quite a luxury and an infinite number of various kinds is prepared. Garum also is manufactured of a color to imitate old honied wine, and flavored so that it can be taken as a drink. Another kind again is dedicated to those religious observances which enjoin strict chastity,† and that prepared from fish without scales is used."‡

Pliny makes other references to Garum, as for instance, in Book IX., Chapter XIX., in a passage which enables us to identify the fish which he names Scomber in the preceding quotation.

"All kinds of fish grow with remarkable rapidity, and more especially those in the Euxine ; the reason of which is the vast number of rivers which discharge their fresh water into it. One fish, the growth of which is quite perceptible, day by day, is known as the Amia. These fish and the Pelamides, together with the Tunnies, enter the Euxine in shoals, for the purpose of obtaining a sweeter nutriment, each under the command of its own leader, but first of all the Scomber appears, which is of a sulphurous tint when in the water, but when out of it resembles other fish in colour. The salt water preserves of Spain are filled with these last fish, but the Tunnies do not consort with them."

In Book IX., chapter 30, there is another reference to Garum. Pliny is writing of the various kinds of Mullet, and he

*Qy.—*αλυκη* (?) written also *hellex*, a pickle or brine, or a salt liquor at the bottom of salt-pits? Cato uses the term Alex also for a small fish.

†In the festival of Ceres, the votaries were obliged to abstain from meat, but were allowed the use of Garum.—Dr. Bostock in the "Sacred Rites of the Jews."

‡This is probably a mistake of Pliny's, as the Jews were not allowed to eat fish without scales. See Lev., Chap. XI., Ver. 10.

says :—"The masters in gastronomy inform us that the Mullet when dying assumes a variety of colours and succession of shades, and that the hue of the red scales, growing paler and paler, gradually changes, more especially if it is looked at enclosed in glass. M. Apicius, a man who displayed great ingenuity in all that related to luxury, states that it is a most excellent plan to let the Mullet die in the pickle known as the 'Garum Sociorum;'"* for we find that even this has found a surname; and he offered a prize for anyone who should invent a new sauce made from the liver of this fish. I find it much easier to relate this fact than to state who it was that gained the prize.

In Book XX., chapter 23, treating of garlic, he says that it is a remedy for leprosy when reduced to ashes and applied as an ointment with oil and garum.

Horace refers to Garum in the 8th Satire, line 46. This poem, as most readers will remember, relates the particulars of the supper given by Nasidienus to Maecenas, Horace, and some of his friends. In the conversation a contemptuous description of the fare is given, with ridiculous comments from the host by way of making every dish pass for something extraordinary. Speaking of a lamprey he says :—

"His mistum jus est oleo quod prima Venafri
Pressit cella, Garo de succis piscis Iberi,
Vino quinquenni, &c.;"

Or, this sauce is of the primeest Venafrian oil mixed with Garum, made from the juice of Spanish fish, five-year-old wine, &c." Commentators vary in their interpretation of the passage. Some say that the Garum was a juice or pickle of certain fishes called Gari which were suffered to dissolve in salt. It is, however, a gratuitous assumption that there ever were such fishes, and if there were it is hard to believe that they were so very soft as to let themselves be dissolved in brine. It is difficult to reconcile this with any kind of evolution which made them salt-water fishes.

* Bostock and Riley translate this expression as "Garum of the Allies," but I prefer to leave it as it is, regarding it as a popular name for the sauce in question.

Others translate the *Garum* and the Spanish fishes by the words Spanish Mackerel, and they bolster up the assumption by stating that these fishes were, or are, very common on the Spanish coast. There is no ground that I know of for the statement; Mackerel have no more right to be called Spanish than Finnish. It is to be hoped that this specimen of classical criticism is not a sample of the whole.

The word is found in Greek lexicons also as *γάρον* and *γάρος* translated *garum*, or a pickle of fish made with salt.

To sum up: the result of these quotations seems to be beyond all doubt, that the *Garum* or *Garos* known to the Romans and Greeks was a sauce composed of fish preserved in brine. It must have been very like the Indian *Balachan*, which is partly fluid, from the fish of which it is composed being allowed to ferment and disintegrate. There appear to have been different kinds amongst the ancients. The word *Garum* is, no doubt, of Sanscrit origin derived from the name of sauce or pickle, represented in Malay and its dialects in the present day by the same, or nearly the same designation.

Professor Stephens of the Sydney University has added at my request the following note:—

It may seem at first sight so improbable that a Malay word should have gained a footing in the vocabulary of Greek and Latin cooks or epicures, that it may be worth our while to consider very briefly the circumstances of the case. The earliest mention of "*Garum*" is made by Cratinus, in the fifth century before the Christian era (apud Ath. II., xxv., 75), "Your basket shall be filled to the rim with *Garum*." Pherecrates, about the same date has "He got his beard with the *Garum* all befouled" (Ath. l.c.). Sophocles (ibid.), "Of the *Garum* of salt fish." Plato, the comic dramatist, "With stinking *Garum* will they drench and smother me." Another passage is quoted by Athenæus from Æschylus, to show that the noun might be masculine or neuter (*γάρος* or *γάρον*). In like manner Pliny uses both *Garos* and *Garum*, H.N., XXXI.,

43-44. This uncertainty as to the proper form points to a foreign origin for the word, for which an otherwise unknown fish, γάπος, is evidently invented to account. Pliny (l.c.) also gives a string of confused notes upon the subject, taken as it seems from his commonplace book, and set down with several errors, omissions, and misplacements. It is, however, plain from this author, as well as from allusions in Horace and Martial, that *Garum* was obtained from the Spanish peninsula, and mainly at Carthagera. It was believed to have been originally made, like the Italian Halec, of small fish, but finally at least the best quality of *Scomber*. This is certainly not Mackerel, but according to Pliny's description, H.N., IX., 19, perhaps the *Coryphæna*, commonly called Dolphin. This looks like the advertisement of a manufacturer. The splendour of colour for which this fish is renowned would to a Roman imagination assuredly suggest some more exquisite flavours than could be found in more homely fish, and this prejudice the foreign pickle merchant would of course turn to his own advantage. Anyhow, it is plain that the Romans knew nothing for certain about its manufacture, but that they obtained what they called Muria—made from Tunny—from Byzantium; that Halec was prepared in Italy from all sorts of fish, and that *Garum* was regarded as infinitely superior to either. The Phœnician origin of Carthagera, and the Eastern commerce of the Phœnicians, reaching as far as Ceylon and Malacca,* might reasonably account for the introduction of an Oriental term into the dictionary of trade; and since the word is evidently foreign to Latin and Greek, the hypothesis of a Malay origin for *Garum* seems probable enough.

Note.—A description of the mode of manufacture is, it must be observed, given in the "Geoponica," at the end of Book XX.; but the work, compiled about A.D. 800, is of slight authority, and is practically anonymous; although, indeed, the account tallies well with the quotation given above from Cratinus, which contains the first mention of the word.

* For the ancient commerce of Ceylon, see "Heeren's Asiatic Nations," Vol. II., Appendix XI.

EXPLANATION OF PLATES.

Fig. 1. *Harpodon nehereus*, C. and V. (The Bombay Duck).

2. *Mastacembelus armatus*, Lacep.

3. *Ophiocephalus micropeltes*, C. and V.

4. *Arius coelatus*, C. and V. (a Siluroid).

5. *Periophthalmus koelreuteri*, Pall. (Hopping Fish).

NOTE.—The above figures are copied from Day's Fishes of India.

NOTES ON THE BACTERIOSCOPICAL EXAMINATION
OF ICE SUPPLIED IN SYDNEY.

BY DR. OSCAR KATZ.

The old-fashioned opinion that water in the frozen state, *i.e.*, as ice, is free from any germs of vegetable micro-organisms, however impure the original water may have been, has, under the weight of modern methods of biological research, had to give way to a contrary view. By recent investigations it has been shown that not only are bacteria capable of enduring a temperature of 0° C., and even a greater cold, but are also endowed with the power of developing after having been exposed to excessively cold temperatures, for a considerable length of time.

C. Fränkel* examined by means of an extended series of culture-experiments, different samples of ice from the supply in Berlin, both natural raw ice and artificial or crystal ice made from ordinary well-water as well as from distilled water. He found that with the exception of ice prepared from distilled water, in which case bacteria were almost entirely absent, the ice never corresponded to the demands of modern hygiene, in so far as it contained too large an amount of bacterial germs.

T. M. Prudden†, investigating the natural raw ice consumed in New York, likewise noticed in the samples an abundance of living micro-organisms, the number of which exceeded considerably the average number in the drinking water of that city.

*"Ueber den Bacteriengehalt des Eises." Zeitschr. f. Hygiene, Bd. I., Heft 2, Leipzig, 1886, pp. 302-314.

†"On bacteria in ice and their relation to disease, with special reference to the ice supply of New York City." Medical Record, 1887, Nos. 13, 14. —Abstract in Centralblatt f. Bakteriologie und Parasitenkunde, Bd. I., No. 22, 1887, p. 650.

So also did G. Bordoni-Uffreduzzi* with reference to the natural ice used in Turin.

On the other hand, the labours of these three investigators resulted in showing that, by the process of freezing, the water rids itself to a large extent from the living bacterial material originally in it. Fränkel, as the first, pointed out (l.c.) that the power of bacteria to resist a great cold was only a limited one, so much so that the ice always contained much fewer bacteria than the original water, that therefore, even water containing a good many microbes may furnish a tolerably good ice. Hence ice rich in bacteria must be looked upon as coming from a very impure water, and in such a case a certain precaution in using it is indicated.

Prudden (l.c.) and Bordoni-Uffreduzzi (l.c.), both arrived at the conclusion that by moderately prolonged freezing, about nine-tenths of the water-bacteria are killed, so that only a small fraction (one-tenth) remain alive.

Prudden (l.c.) undertook also a series of experiments with the view of ascertaining how a limited number of known microbes—pathogenic and non-pathogenic ones—behaved themselves when exposed (in sterilised water) to the effects of an artificially produced cold, as far as $-24^{\circ}\text{C}.$, for a period up to 103 days. He obtained the remarkable result that pathogenic species withstood such an excessive cold much longer than non-pathogenic ones. While, for instance, *Micrococcus prodigiosus*, showing before freezing 6300 colonies in 1 ccm., was killed after 51 days' uninterrupted freezing; a liquefying bacillus from water, with at first 800,000 in 1 ccm., after 4 days; *Staphylococcus pyogenes aureus* derived from a vigorous culture, with innumerable germs in 1 ccm. of water at the commencement, still contained 50,000 living individuals after 66 days; and the bacillus of typhoid fever, showing after 11 days one million germs, 7000 colonies in 1 ccm. after 103 days. On the other hand, an alternate freezing

*"Die biologische Untersuchung des Eises in seiner Beziehung zur öffentlichen Gesundheitspflege" Centralbl. f. Bakteriologie und Parasitenkunde, Bd. II., No. 17, 1887, pp. 489-497.

and thawing of the water mixed with bacteria, causes them to perish in a comparatively short time. The ability possessed by bacteria to resist great cold differs according to the species, and is dependent on the conditions of life in which the organisms were before being subjected to the experiments under consideration. (As I have been unable to consult the Medical Record I do not know whether any of the bacilli experimented upon by Prudden were in a spore-formation or not ; this, of course, has to be taken into account when judging of the relative degree of the power of resistance of microbes against excessive cold or otherwise.)

Bordoni-Uffreduzzi (l.c.), in contradistinction to Prudden (who employed artificial excessive cold), found that the natural raw ice, six months after its formation, exhibited nearly the same quantity of bacterial germs as on the first day. This result, which is contrary to Prudden's conclusion that the number of micro-organisms in naturally frozen water diminishes in proportion to the duration of freezing, is, he says, to be accounted for by the divergence of the conditions under which the experiments were carried out in either case.

From a sanitary point of view a biological investigation of the ice from the supply in Sydney, seemed to me to be not without interest; so much the more as the consumption of ice in this City and its suburbs, during the summer months, is by no means insignificant. For instance, the weekly sale from the works of the "New South Wales Fresh Food and Ice Company," is about 120 tons, of which almost all is used here.

The investigations made by me were chiefly for the purpose of ascertaining the quantity of bacterial life in the different ice samples. I could not examine the water which was used each time for the preparation of ice—as a matter of course we have here only artificially produced ice—but I could refer, to some extent, to the analyses of pipe-water (from the tap in the Linnean Hall) which I had made during 1886 and 1887, and also to a few recently made examinations. This water comes from the same source (Nepean River), as that supplied to the Sydney Ice-works

As will be seen below, the ice is nearly always used soon after it is made, so that the question as to the living contents of ice-samples of various ages is only of subordinate significance. For the sake of uniformity I always analysed the ice-samples when they were fresh, no more than about one day old.

There are at the present time three local ice-manufacturing companies.

(1) The above-mentioned "New South Wales Fresh Food and Ice Company," Harbour-street. To Mr. W. G. Lock, Manager of this Company, I am indebted for the following information which I am permitted to give verbatim.* "The water used by this company for the manufacture of ice is that supplied to the City and Suburbs of Sydney, but previous to being thus employed it is carefully filtered, first through a quantity of compressed sponges and then through beds of animal charcoal. The ice is generally supplied to customers as soon as manufactured, but on account of the irregularity of the trade, and the necessity of not being entirely dependent on the working of the machines for the extra quantities of ice required during the hottest weather, a stock of some 400 or 500 tons is accumulated during the winter months which gradually diminishes during the summer, so that occasionally the ice sent out has been stored here for some three to nine months. Our average weekly sale is about 120 tons, so that the quantity distributed of ice that has been kept is a very small proportion. The principle of preparing the ice may be thus described. The water must be frozen from cells formed of two vertical plates placed equidistant in a large tank containing the filtered water; these cells have a hollow space in them through which the refrigerating medium is made to flow, the water in the tank is gradually frozen from the cells outwards, until the ice has attained a thickness of from four to five inches when the liquid circulating through the cells is heated, the ice released from them, hoisted, and cut up by machinery. By this method of freezing from one side of the plate only and never allowing the formation

*I have also to acknowledge with thanks his liberality in providing all the ice required gratis.

on two different plates at certain distances from each other to freeze together, any remaining impurities are thrown off from the ice into the water, leaving the former perfectly clear and transparent "

(2) The "City Ice Company," Dibbs' Wharf, Miller's Point. According to the information kindly furnished to me by the Manager, Mr. C. S. Walker, the water used here is also the City water, but condensed (distilled) before being put into the moulds. The ice is supplied according to the demands, both directly it is manufactured and after having been in stock for from one day to three months. The machines are worked on the ammonia absorption principle.

(3) The "Sydney Ice Company," Harris-street, Pyrmont.

With regard to the ice from the works of this company, I regret not to be able to give any satisfactory data, because my letters asking for information, or for the delivery of samples of ice, remained unanswered. Yet I examined (see below), a few samples obtained elsewhere. The water used at these works is also the common Sydney water, and the process of ice-manufacture will, in principle, be the same as that in use at the others.

Before giving notice of the results of the bacterioscopical examination of the Sydney ice as to their contents of microbial life, I wish to say a few words about the method of examining employed by me. It is, I think, needless to repeat the fundamental rules to be observed in the carrying out of such or similar work ; in speaking of the nutritive gelatine, of glass vessels, &c., used, it is a matter of course implied that they were properly sterilised.

The ice-samples which I received from the "N.S.W. Fresh Food and Ice Company" (in 10lbs. blocks), and from the "City Ice Company" (in 8lbs. blocks) were, as already alluded to, not more than about one day old ; samples coming from the "Sydney Ice Company" I obtained in about 3lbs. pieces from a shop near Elizabeth Bay. I was told that they were freshly made.

In order to secure, in a suitable and unobjectionable manner, a sufficient quantity of ice-water for analysis—the ice having, of course, to be melted—I derived from the samples, by means of a clean hammer, several medium-sized pieces, which, held by a sterilised brass-tongue, were thoroughly washed by allowing filtered rain-water carefully and for some time to flow over them. (This rain-water had been boiling over the open flame for about three hours). They were then placed and gathered in a glass funnel (holding about 200 ccm.), which was covered by another glass funnel of the same dimensions, and having a cotton-wool stopper at its apex. After about ten minutes, during which time a quantum of ice-water was allowed to waste, I put a small Erlenmeyer's (or parting) flask (of 120-130 ccm. capacity) under, the remaining portion of the mouth of which was covered with sterile cotton-wool. In this way any possible contamination from without was avoided. According to the temperature of the room—the examinations took place in January and February, that is, in the middle of our semi-tropical summer—it lasted from three-quarters to one hour, till 30-50 ccm. of melted ice had accumulated in the glass-flask. I then removed it, replaced the stopper, shook its contents gently and repeatedly, and immediately afterwards proceeded to prepare cultures. The fact that the number of bacteria in any sample of water increases considerably when the latter is allowed to stand for some time, especially at favourable temperatures, renders the immediate examination of the water (or of the melted ice) a matter of necessity. For instance, a sample of fresh ice-water yielded in 1 ccm. on the average 407, in $\frac{1}{2}$ ccm. 194 bacterial colonies. After 54 hours, at a temperature up to 28°C., the same sample contained in one drop (= 1-18 ccm.) innumerable numbers of colonies.

The nutritive soil which served me for the cultivation of the germs in the ice was a 10 p.c. nutritive gelatine, of a slightly alkaline reaction. To each sample of ice I took four gelatine-tubes, of which two were inoculated each with 1ccm., and the two others each with $\frac{1}{2}$ ccm. of the ice-water. The liquid gelatine mixed homogeneously with such quantities of water, I solidified after Esmarch's "roll-method," which is sufficiently known. The

temperature at which these culture-tubes were kept, amounted in its maximum to $79^{\circ}\text{F.} = 26\frac{1}{3}^{\circ}\text{C.}$, in its minimum to $71^{\circ}\text{F.} = 21\frac{2}{3}^{\circ}\text{C.}$ The colonies were counted after 40-70 hours' incubation; the appearance in the tubes of rapidly liquefying colonies rendered an early counting now and then necessary. Where it was possible, the colonies were counted throughout; in other cases the number of germs was calculated from the average number of colonies in 6-10 $\square\text{cm.}$, or (one case) in quite as many $\frac{1}{4}\square\text{cm.}$

I will now put together the results of the examination of the ice-samples from the three works in tables, the arrangement of which scarcely needs any further explanation.

“NEW SOUTH WALES FRESH FOOD AND ICE COMPANY.”

Day when cultures were prepared.	Day when colonies were counted.	Interval in hours.	Temperature of incubation.	Colonies either counted throughout or calculated.	Number of colonies	
					in 1 ccm.	in $\frac{1}{2}$ ccm.
1888.	1888.					
Jan. 18	Jan. 20	40	$75-79^{\circ}\text{F.} = 23\frac{8}{9}-26\frac{1}{9}^{\circ}\text{C.}$	Counted...	$\frac{74}{87}$	$\frac{31}{27}$
„ 26	„ 28	53	$74-77^{\circ}\text{F.} = 23\frac{1}{3}-25^{\circ}\text{C.}$	Counted...	$\frac{6}{7}$	$\frac{0}{1}$
„ 27	„ 29	48	$74-77^{\circ}\text{F.} = 23\frac{1}{3}-25^{\circ}\text{C.}$	Counted...	$\frac{81}{53}$	$\frac{23}{37}$
„ 30	Feb. 1	50	$73-78^{\circ}\text{F.} = 22\frac{2}{3}-25\frac{5}{9}^{\circ}\text{C.}$	Counted...	$\frac{82}{107}$	$\frac{29}{44}$
Feb. 1	„ 4	64	$74-78^{\circ}\text{F.} = 23\frac{1}{3}-25\frac{5}{9}^{\circ}\text{C.}$	Counted...	$\frac{6}{5}$	$\frac{2}{2}$
„ 4	„ 7	70	$73\cdot5-77^{\circ}\text{F.} = 23\frac{1}{18}-25^{\circ}\text{C.}$	Counted...	$\frac{2}{2}$	$\frac{3}{1}$
„ 7	„ 10	68	$73-77^{\circ}\text{F.} = 22\frac{2}{9}-25^{\circ}\text{C.}$	Counted...	$\frac{3}{1}$	$\frac{1}{0}$
„ 10	„ 13	70	$72\cdot5-76^{\circ}\text{F.} = 22\frac{1}{2}-24\frac{4}{9}^{\circ}\text{C.}$	Counted...	$\frac{0}{1}$	$\frac{0}{0}$
„ 11	„ 14	60	$74-75^{\circ}\text{F.} = 23\frac{1}{3}-23\frac{5}{9}^{\circ}\text{C.}$	Cal. (1 ccm.)		
				Ctd. ($\frac{1}{2}$ ccm.)	$\frac{498}{603}$	$\frac{203}{215}$
„ 15	„ 17	48	$72-74\cdot5^{\circ}\text{F.} = 22\frac{2}{9}-23\frac{11}{18}^{\circ}\text{C.}$	Calculated	$\frac{17674}{17374}$	$\frac{9379}{8938}$
„ 17	„ 20	70	$71-74^{\circ}\text{F.} = 21\frac{2}{3}-23\frac{1}{3}^{\circ}\text{C.}$	Counted...	$\frac{8}{5}$	$\frac{2}{2}$
„ 19	„ 21	48	$72-76\cdot5^{\circ}\text{F.} = 22\frac{2}{9}-24\frac{13}{18}^{\circ}\text{C.}$	Counted...	$\frac{400}{414}$	$\frac{221}{167}$

In looking over this table one notices at once a rather great difference between the individual results obtained. In the great majority of cases there was only a limited number of germs in 1ccm. and $\frac{1}{2}$ ccm. respectively; in some there were none at all; while in two the colonies amounted to some hundred, and in one case to the enormous number of 17,000-18,000 per ccm. From the given figures we may well conclude that the quantity of bacterial germs in the ice from the above company kept in general within reasonable limits, and that in those few cases where several hundred or several thousand colonies made their appearance, I must have hit upon spots where the water before freezing was much contaminated, some how or other. We shall have to come back once more to this ice.

"CITY ICE COMPANY."

Day when cultures were prepared.	Day when colonies were counted.	Interval in hours.	Temperature of incubation.	Colonies either counted throughout or calculated.	Number of colonies	
					in 1 ccm.	in $\frac{1}{2}$ ccm.
1888.	1888.					
Jan. 17	Jan. 19	54	75-79°F. = 23 $\frac{8}{9}$ -26 $\frac{1}{9}$ °C.	Calculated	2285 2269	1370 1246
" 19	" 22	67	75-78°F. = 23 $\frac{8}{9}$ -25 $\frac{5}{9}$ °C.	Counted...	77 84	39 47
" 21	" 24	67	74-76°F. = 23 $\frac{1}{3}$ -24 $\frac{4}{9}$ °C.	Counted...	85 112	28 47
" 24	" 27	66	72.5-76°F. = 22 $\frac{1}{2}$ -24 $\frac{4}{9}$ °C.	Calculated	3149 3389	1680 1490
" 26	" 28	48	74-77°F. = 23 $\frac{1}{3}$ -25°C.	Counted...	674 772	360 liquefied
" 28	" 30	42	72.5-76.5°F. = 22 $\frac{1}{2}$ -24 $\frac{13}{18}$ °C.	Counted...	656 561	301 261
" 31	Feb. 2	54	73.5-78°F. = 23 $\frac{1}{18}$ -25 $\frac{5}{9}$ °C.	Counted...	123 130	73 55
Feb. 2	" 5	66	74-78°F. = 23 $\frac{1}{3}$ -25 $\frac{5}{9}$ °C.	Counted...	941 1111	484 395
" 4	" 7	70	73.5-77°F. = 23 $\frac{1}{18}$ -25°C.	Counted...	2 0	0 0
" 7	" 10	70	73-77°F. = 22 $\frac{2}{3}$ -25°C.	Counted...	67 73	28 33
" 9	" 12	70	72.5-76°F. = 22 $\frac{1}{2}$ -24 $\frac{4}{9}$ °C.	Counted...	297 270	137 153
" 11	" 14	62	74-75°F. = 23 $\frac{1}{3}$ -23 $\frac{8}{9}$ °C.	Counted...	2 0	1 0

As will be seen these figures are, on the whole, higher than those with regard to the ice from the works of the N.S.W. Fresh Food and Ice Company, while, it must be acknowledged, in two instances the samples were free from living micro-organisms. This fact of the presence of a multitude of colonies in the majority of the samples tested is somewhat surprising, because the City Ice Company uses (for the time being) only water that has been condensed from vapour before being put into the iron-moulds to freeze. Therefore, we can only say that this condensed or distilled water became contaminated when transferred to the moulds—the samples of ice which I obtained were derived from moulds containing about 16lbs. water—or while in them. More than once I met with quite an assortment of the most different colonies of bacteria (pigment-bacteria, etc.), which are usually not inhabitants of Sydney tap-water. A feature common to the condition of the ice of both the named works was that liquefying colonies were in proportion nearly always exceedingly few. The proportion of liquefying colonies to non-liquefying ones in the water from the Sydney supply has proved to be larger.

“SYDNEY ICE COMPANY.”

Day when cultures were prepared.	Day when colonies were counted.	Interval in hours.	Temperature of incubation.	Colonies either counted throughout or calculated.	Number of colonies	
					in 1 ccm.	in $\frac{1}{2}$ ccm.
1888.	1888.					
Feb. 15	Feb. 17	48	72-74°F. = 22 $\frac{2}{3}$ -23 $\frac{11}{18}$ °C.	Calculated	2345 2393	944 897
„ 20	„ 22	42	74-76.5°F. = 23 $\frac{1}{3}$ -24 $\frac{13}{18}$ °C.	Counted...	438 435	217 204
„ 23	„ 25	46	74-78°F. = 23 $\frac{1}{3}$ -25 $\frac{5}{9}$ °C.	Counted...	77 84	40 38

In reference to the behaviour of the cultures from this ice, which to judge from the few tests made, contained too many germs, at least in the first two instances, I may mention that they differed at first glance from those of the ice from the two other works, in

so far as liquefying colonies were proportionately far more numerous, thus resembling, as it were, cultures made from the ordinary Sydney tap-water.

From the results thus obtained, it may be inferred that the quality of the Sydney ice could not always be pronounced to come up to what a good drinking-water is required to be from the standpoint of public sanitation. While, on the one hand, it was gratifying to learn that not few samples (notably with reference to the ice from the works of the N.S.W. Fresh Food and Ice Company), proved themselves absolutely free or tolerably free from living bacterial elements, on the other hand, some objection must be taken to a series of other samples, since they were inhabited by rather too large numbers of living microbes to be passed as fit for being used as additions to articles of food, or in the treatment of wounds. But it would be unjustifiable to say that a sample of water or ice must be looked upon as objectionable, solely for the reason of its containing large quantities of germs; as has already been pointed out by other observers, the danger is that if such is the case, pathogenic species might possibly also be present among them. However, a rough examination of the colonies obtained in the gelatine-tubes from the Sydney ice showed that there were, so far as known, no infectious organisms. As already alluded to, the colonies were not always exclusively such as we are accustomed to find in the water from the Sydney supply. My impression is, that the water to be transformed to ice received, somehow or other, at least in a number of instances, secondary microbial material from without. Were we to apply to the condition of the Sydney ice in each case the law made out by Prudden (l.c.), and Bordoni-Uffreduzzi (l.c.), namely, that 90p.c. of the water-bacteria become destroyed by the process of freezing, we should arrive at figures which, my examinations of the Sydney Tap Water (these Proceedings, 2nd Series, Vol. I., pp. 907, 1205; Vol. II., pp. 151, 329.), lead me to believe, do not appear to hold true for this water.

The bacteriological analysis of fifty-six samples of water from the Sydney supply (derived from a tap in the Linnean Society's

Laboratory, Elizabeth Bay* made during 1886-1887, resulted in showing that the average number of bacterial colonies in 1ccm. was 246, that the majority of figures kept within reasonable limits, and that in two cases only there were 2000 colonies for 1ccm. According to a few tests of the same water, made while I was examining the Sydney ice, the number of colonies did not exceed 200.

We may conclude by saying that the Sydney ice would always be found perfectly pure, that is free from any germs of whatever description, if, instead of filtered water, only distilled water was used, and the chances for secondary contaminations during the process of freezing, carefully avoided.

* This water, as mentioned above, comes from the same source (Nepean River), as that supplied to the Ice-works in Sydney. I am well aware that a comparison of the above kind can only be approximative; more satisfactory it would have been if a test had been made of the water from the works just before being made to ice, but it was not possible for me to do so.

FLOWERING SEASONS OF AUSTRALIAN PLANTS.

BY E. HAVILAND, F.L.S.

NO. 8.—LIST OF PLANTS FLOWERING IN THE NEIGHBOURHOOD OF
SYDNEY DURING THE MONTHS OF APRIL, MAY AND JUNE,
IN ADDITION TO THOSE ENUMERATED IN FORMER LISTS —

APRIL.

Myrtaceæ—

Eucalyptus corymbosa

Bæckeia linifolia.

Proteaceæ—

Petrophila pulchella.

Convolvulaceæ—

Ipomœa palmata.

Epacridææ—

Dracophyllum secundum.

Labiatae—

Mentha satureoides.

Orchideæ—

Pterostylis obtusa

„ *acuminata*

Acianthus excertus

Prasophyllum striatum.

MAY.

Apocynææ—

Lyonsia reticulata.

Leguminosæ—

Acacia linearis

„ *hispidula.*

Epacridææ—

Astroloma pinifolia

„ *humifusa.*

Orchideæ—

Pterostylis ophioglossa

Corysanthes fimbriata.

Compositæ—

Craspedia Richea.

Vernonia cinerea

Siegesbeckia orientalis.

Jasmineæ—

Notelœa longifolia.

Campanulaceæ—

Lobelia purpurascens.

Proteaceæ—

Hakea gibbosa.

Myrtaceæ—

Melaleuca leucadendron

JUNE.

Rutaceæ—

*Acronychia levis**Zieria laevigata**Eriostemon Crowei.*

Leguminosæ—

*Vigna lutea**Phyllota phyllicoides**Acacia linifolia.*

Saxifragæ—

Bauera capitata.

Orchideæ—

*Liparis reflexa**Prasophyllum rufum.*

Euphorbiaceæ—

Croton Verreauxii

Myrtaceæ—

*Eugenia Ventenatii**Bæckeia diffusa.*

NOTES ON THE NESTING OF *ALCYONE PULCHRA*,
GOULD.

BY A. J. NORTH, F.L.S.

In a collection of birds recently formed on behalf of the Trustees of the Australian Museum, by Messrs. E. J. Cairn and Robt. Grant, in the neighbourhood of Mt. Bellenden-Ker, Northern Queensland, are two specimens of *Alcyone pulchra*. One of them was obtained with great difficulty, on the Barron River, about thirty miles inland from the coast, by Mr. Cairn, who, having shot the bird, had to swim to procure it. The other was captured on the nest by Mr. Grant. It is worthy of note that, after comparing these birds with a large series of *A. pulchra* from Cape York, Port Essington and Port Darwin, the flanks are not tinged so deeply with rich lilac as in the specimens from the extreme northern localities; but are similar to others of the same species procured by Mr. Cairn at Derby, North-western Australia in 1886.

Mr. Grant has kindly supplied me with the following information relative to the taking of the nest.

"On the 26th of December 1887, at Riverstone, about sixteen miles inland from Cairns, in company with an aboriginal called "Charlie" (native name Euryimba), I saw a Kingfisher fly into a hole in the bank of a creek; after running forward and placing my hat over the entrance, I with my sheath-knife enlarged the opening, and putting my hand in caught one of the parents; while engaged in securing it, my attention was drawn away from the nest for a moment, when to my surprise another bird flew

out, so both of the parent birds were in the hole at the same time. The bird I captured, afterwards upon dissection, proved to be a male. The nest if worthy of the name, was placed near the end of the tunnel, which was about sixteen inches in length, and inclined upwards; it was composed of a few cast fish bones, and small pieces of decayed roots, but in all not sufficient to protect the eggs from the sandy soil at the bottom. The nest contained five eggs, three of which were unfortunately broken."

The two remaining eggs, which I exhibit here to-night, are similar to those of the southern representative, *A. azurea*, being rounded in form, pearly white, with the texture of the shell fine and very glossy. Length (A), 0.87×0.73 inch; (B), 0.85×0.74 inch. (*From the Aust. Mus. Coll.*)

CATALOGUE OF THE KNOWN COLEOPTERA OF NEW
GUINEA, INCLUDING THE ISLANDS OF NEW
IRELAND, NEW BRITAIN, DUKE OF YORK, ARU,
MYSOL, WAIGIOU, SALWATTY, KEY, AND JOBIE.

BY GEORGE MASTERS.

Family CICINDELIDÆ.

CICINDELA. Linné.

- 1 ALBERTISI, Gestro, Ann. Mus. Genov. XV. 1879, p. 554.
Fly River, New Guinea.
- 2 DECEMGUTTATA, Fabr. Syst. El. I. p. 241 ; Guér. Voy. Coquille,
1830, p. 58, t. 1, f. 1 ; Gestro, Ann. Mus. Genov. XV.
1879, p. 555. Fly River, New Guinea.
- 3 DELICATA, Bates, Ent. Month. Mag. X. 1874, p. 265.
New Guinea.
- 4 DURVILLEI, Dej. Spec. V. p. 225 ; Guér. Voy. Coquille, 1830,
p. 58, t. 1, f. 2 ; Maccl. Proc. Linn. Soc. N.S.W. X. 1884,
p. 701. New Guinea.
- 5 FUNERATA, Boisd. Voy. Astrol. II. 1835, p. 4, t. 6, f. 1 ; Gestro,
Ann. Mus. Genov. XV. 1879, p. 556 ; Maccl. Proc. Linn.
Soc. N.S.W. (2) I. 1886, p. 137.
Fly River, New Guinea.
- 6 INTERRUPTA, Fabr. Syst. El. I. p. 243 ; Gestro, Ann. Mus.
Genov. XV. 1879, p. 556. Katow, New Guinea.
- 7 KRAATZI, Dokht, Rev. Mens. Ent. I. 1883, p. 10.
New Guinea.
- 8 LATREILLEI, Guér. Voy. Coquille, 1830, p. 57, t. 1, f. 5.
Latreilleana, Boisd. Voy. Astrol. II. p. 2. New Guinea.
- 9 LUCASI, Dokht, Rev. d'Ent. I. 1882, p. 274. New Guinea.

272 CATÁLOGUE OF THE KNOWN COLEOPTERA OF NEW GUINEA,

- 10 MAINO, Maccl. Proc. Linn. Soc. N.S.W. I. 1876, p. 165.
Katow, N. Guinea.
- 11 PLACIDA, Schaum, Journ. of Ent. II. 1863, p. 60. Mysol.
- 12 PUPILLATA, Schaum, l.c. p. 60. Mysol.
- 13 PUPILLIGERA, Chaud. Cat. Coll. 1865, p. 59. New Guinea.
- 14 TETRACHOIDES, Gestro, Ann. Mus. Genov. VIII. 1876, p. 514.
Hatam, Fly River, &c., New Guinea.
- 15 VARIOLOSA, Blanch. Voy. Pole Sud, IV. p. 6, t. 1, f. 4.
New Guinea.

DISTYPSIDERA. Westwood.

- 16 PAPUANA, Gestro, Ann. Mus. Genov. XIV. 1879, p. 556.
Katow, Fly River, New Guinea.

THERATES. Latreille.

- 17 BASALIS, Dej. Spec. II. p. 437; Jc. I. t. 6, f. 6; Guér. Voy.
Coquille, Ins. t. 1, f. 6; d'Urville, Dej. Cat. 3 ed. p. 7;
Maccl. Proc. Linn. Soc. N.S.W. (2) I. 1886, p. 137.
Fly River, &c., New Guinea.
- 18 CÆRULEUS, Latr. Jc. I. p. 64, t. 1, f. 2. New Guinea.
- 19 DICHROMUS, Thoms. Arc. Nat. 1859, p. 92. New Guinea.
- 20 FESTIVUS, Boisd. Voy. Astrol. II. p. 13; Schaum, Berl. Ent.
Zeit. 1860, p. 184. New Guinea.
- 21 LABIATUS, Fabr. Syst. El. I. p. 232; Dej. Spec. I. p. 158;
Bon. Mem. Ac. Torin. XXIII. p. 248, f. 1-11; Lacord.
Gen. Atl. t. 1, f. 5, a. New Guinea.
- 22 MISORIENSIS, Raffray, Bull. Soc. Ent. Fr. (5) VIII. 1878,
p. xcvi. New Guinea.
- 23 SCAPULARIS, Chaud. Cat. Coll. 1865, p. 55. Mysol.

TRICONDYLA. Latreille.

- 24 APTERA, Oliv. Ent. II. 33, p. 7, t. 1, f. 1; Dej. Spec. II.
p. 483; Jc. t. 2, f. 6; Guér. Jc. t. 3, f. 3; Maccl. Proc.
Linn. Soc. N.S.W. (2) I. 1886, p. 137.
connata, Lamark, Anim. s. verteb. ed. 2, IV. p. 677.
Fly River, &c., New Guinea.

Family CARABIDÆ.

ODACANTHA. Fabricius.

- 25 DUBIA, Gestro, Ann. Mus. Genov. XIV. 1879, p. 558.
Fly River, New Guinea.

CASNOIDEA. Castelnau.

- 26 DIMIDIATA, Fairm. Notes Leyd. Mus. IX. 1887, p. 192. Aru.

DRYPTA. Fabricius.

- 27 SULGICOLLIS, Putzeys, Ann. Mus. Genov. VII. 1875, p. 721.
Andai, New Guinea.
- 28 FUMIGATA, Putzeys, l.c. p. 721. Andai, New Guinea.

PLANETES. W. S. Macleay.

- 29 UNICOLOR, Maccl. Proc. Linn. Soc. N.S.W. (2) I. 1886,
p. 137. Fly River.

POGONOGLOSSUS. Chaudoir.

- 30 SCHAUMII, Chaud. Rev. et Mag. Zool. 1869, p. 204. Mysol.

PHEROPSOPHUS. Solier.

- 31 PAPUENSIS, Maccl. Proc. Linn. Soc. N.S.W. I. 1876, p. 166; l.c.
(2) I. 1886, p. 137. Katow, Fly River, &c.

BRACHINUS. Weber.

- 32 FRONTALIS, Chaud. Col. Nov. I. 1883, p. 18.
Fly River, New Guinea.

COPTODERA. Chaudoir.

- 33 CYANELLA, Bates, Ent. Month. Mag. 1869, p. 75.
New Guinea.
- 34 LINEOLATA, Bates, l.c. p. 75. New Guinea.

LEBIA. Latreille.

- 35 PAPUENSIS, Maccl. Proc. Linn. Soc. N.S.W. I. 1876, p. 167.
Katow, New Guinea.

PHLÆODROMIUS. Macleay.

- 36 PLAGIATUS, Maccl. Proc. Linn. Soc. N.S.W. I. 1876, p. 167.
Yule Island, New Guinea.

CATASCOPUS. Kirby.

- 37 AMÆNUS, Chaud. Berl. Zeit. 1861, p. 120. New Guinea.
38 ARUENSIS, Saund. Trans. Ent. Soc. Lond. 1863, p. 458, t. 17,
f. 5. Aru.
39 ELONGATUS, Saund. l.c. p. 466, t. 18, f. 5, a-b.
Dorey, New Guinea.

- 40 CUPRICOLLIS, Chaud. Col. Nov. I. 1883, p. 24.
Fly River, New Guinea.

- 41 OBLIQUATUS, Fairm. Le Nat. 1881, p. 381. New Britain.

- 42 WALLACEI, Saund. Trans. Ent. Soc. Lond. 1863, p. 462, t. 17,
f. 4, a-b. Waigiou.

STRICKLANDIA. Macleay.

- 43 PERICALLOIDES, Maccl. Proc. Linn. Soc. N.S.W. (2) I. 1886,
p. 139. Fly River.

PAMPONERUS. Fairmaire.

- 44 GODEFFROYI, Fairm. Le Nat. 1881, p. 381.
Duke of York Island.

MISCELUS. Klug.

- 45 MORIOFORMIS, Maccl. Proc. Linn. Soc. N.S.W. I. 1876, p. 168.
Hall Sound, New Guinea.

- 46 STYGICUS, Putzeys, Ann. Mus. Genov. VII. 1875, p. 726.
New Guinea.

PERIGONA. Castelnau.

- 47 PLAGIATA, Putzeys, Ann. Mus. Genov. VII. 1875, p. 734.
Aru.

- 48 SUBCYANESCENS, Putzeys, l.c. p. 732. New Guinea.

- 49 SUTURALIS, Putzeys, l.c. p. 728. New Guinea.

PSEUDOZÆNA. Castelnau.

- 50 ALTERNATA, Bates, Proc. Zool. Soc. 1877, p. 152, t. 24, f. 2.
Duke of York Island.

MORIO. Latreille.

- 51 LONGIPENNIS, Putzeys, Ann. Mus. Genov. VII. 1875, p. 727.
New Guinea.

- 52 STOLIDUS, Chaud. Bull. Mosc. LV. p. 336; Macl. Proc. Linn.
Soc. N.S.W. (2) I. 1886, p. 140.

Fly River, New Guinea.

CHLÆNIUS. Bonelli.

- 53 GUTTATUS, Esch. Zool. Atl. V. p. 26, t. 25, f. 8; Fairm. Rev.
Zool. 1849, p. 282; Ann. Soc. Ent. Belg. XVII. 1883,
p. 3. New Britain.

- 54 NIGRIPES, Macl. Proc. Linn. Soc. N.S.W. (2) I. 1886,
p. 140. Fly River, New Guinea.

OODES. Bonelli.

- 55 LÆVISSIMUS, Chaud. Ann. Soc. Ent. Fr. (6) II. 1882, p. 361,
New Guinea.

HOPOLENUS. Laferté.

- 56 CYLLODINUS, Fauvel, Rev. d'Ent. I. 1882, p. 266.
New Guinea.

HARPALUS. Latreille.

- 57 PAPUENSIS, Macl. Proc. Linn. Soc. N.S.W. I. 1876, p. 168.
Hall Sound, New Guinea.

LESTICUS. Dejean.

- 58 POLITUS, Chaud. Ann. Soc. Ent. Belg. XI. p. 156; Macl. Proc.
Linn. Soc. N.S.W. (2) I. 1886, p. 141.
Fly River, New Guinea.

DRIMOSTOMA. Dejean.

- 59 NOVÆ-BRITANNIÆ, Fairm. Le Nat. V. 1883, p. 238.
New Britain.

- 60 SUBSINUATUM, Chaud. Col. Nov. I. 1883, p. 38.
Fly River, New Guinea.

PLATYCOELUS. Blanchard.

- 61 DEPRESSUS, Blanch. Voy. Pole Sud, 1853, p. 25, t. 2, f. 10.
New Guinea.

COLPODES. W. S. Macleay.

- 62 VIOLACEUS, Chaud. Mon. Ann. Soc. Ent. Fr. 1859, p. 351.
Aru.

CILLENUM. Curtis.

- 63 ALBERTISI, Putzeys, Ann. Mus. Genov. VII. 1875, p. 748.
New Guinea.

Family DYTISCIDÆ.

COPELATUS. Erichson.

- 64 HÆMORRHOIDALIS, Régim. Notes Leyd. Mus. V. 1883, p. 229.
Aru.

- 65 POLITUS, Sharp, Trans. Dubl. Soc. II. 1882, p. 568.
New Guinea.

HYDATICUS. Leach.

- 66 FLAVOCINCTUS, Guér. Voy. Coquille, II. p. 61, t. 1, f. 18.
New Guinea.

- 67 BIHAMATUS, Aubé, Spec. p. 174 ; Fairm. Ann. Soc. Ent. Belg.
XVII. 1883, p. 3. New Guinea and New Britain.

Family GYRINIDÆ.

MACROGYRUS. Régimbart.

- 68 BLANCHARDI, Régim. Ann. Soc. Ent. Fr. (6) II. 1882, p. 442.
New Guinea.

- 69 ELONGATUS, Régim. l.c. p. 447. Aru.

- 70 OBERTHUERI, Régim. l.c. p. 446. New Guinea.

- 71 PURPURASCENS, Régim. l.c. p. 453, t. 12, f. 64. New Guinea.

ENHYDRUS. Castlenau.

- 72 ALBERTISI, Régim. Ann. Mus. Civ. Genov. XVIII. 1882, p. 70.
Fly River

- 73 FROGGATTI, Macl. Proc. Linn. Soc. N.S.W. (2) 1886, p. 141.
Fly River.

DINEUTES. W. S. Macleay.

74 MARGINATUS, Sharp, Trans. Ent. Soc. Lond. 1873, p. 56.

quadrispina, Fairm. Ann. Soc. Ent. Fr. 1878, p. 88.

Fly River.

75. PECTORALIS, Régim. Ann. Soc. Ent. Fr. (6) II. 1882, p. 419.

Andai, New Guinea.

Family HYDROPHILIDÆ.

ALLOCOTOCERUS. Kraatz.

76 BEDELI, Kraatz, Deutsche Ent. Zeit. XXVII. 1883, p. 15.

New Guinea.

Family STAPHYLINIDÆ.

ALEOCHARA. Gravenhorst.

77 ASIATICA, Kraatz, Wieg. Arch. 1859, I. p. 15.

japonica, Sharp, Trans. Ent. Soc. Lond. 1874, p. 8 ; Fauvel,

Ann. Mus. Genov. XII. 1878, p. 306.

Aru, &c.

POLYPEA. Fauvel.

78 CORALLI, Fauv. Ann. Mus. Genov. XII. 1878, p. 302, t. 2, f. 37.

Aru.

FALAGRIA. Mannerheim.

79 BASALIS, Fauv. Ann. Mus. Genov. XII. 1878, p. 310.

Aru, Salwatty, New Guinea.

80 FORMICARIA, Fauv. l.c. XV. 1879-80, p. 120.

Fly River.

OPHIOGLOSSA. Fauvel.

81 NOVÆ-GUINÆÆ, Fauv. Ann. Mus. Genov. XII. 1878, p. 308,

t. 2, f. 39.

New Guinea.

MYRMECOPORA. Saulcy.

82 INSIGNICORNIS, Fauv. Ann. Mus. Genov. XII. 1878, p. 303,

t. 2, f. 38.

Hatam, New Guinea.

BOLITOCHARA. Mannerheim.

- 83 ANNULARIS, Fauv. Ann. Mus. Genov. XV. 1879-80, p. 118.
Dorey, New Guinea.
84 SPINOSA, Fauv. l.c. XII. 1878, p. 307. Dorey, New Guinea.

HOMALOTA. Mannerheim.

- 85 ARUENSIS, Fauv. Ann. Mus. Genov. XII. 1878, p. 296. Aru.
86 BASALIS, Fauv. l.c. p. 295. Dorey, Andai, New Guinea.
87 LACHRYMOSA, Fauv. l.c. XV. 1879-80, p. 111.
Dorey, New Guinea.
88 HATAMENSIS, Fauv. l.c. XII. 1878, p. 295.
Hatam, New Guinea.

THAMIARÆA. Thomson.

- 89 INSIGNIVENTRIS, Fauv. Ann. Mus. Genov. XII. 1878, p. 299,
t. 2, f. 36. Andai, New Guinea.

THECTURA. Thomson.

- 90 CRIBRUM, Fauv. Mus. Genov. XII. 1878, p. 297.
Andai, New Guinea.

GYROPHÆNA. Mannerheim.

- 91 BASICORNIS, Fauv. Ann. Mus. Genov. XII. 1878, p. 292.
Key Island.
92 EBENINA, Fauv. l.c. p. 290. Aru.
93 MICROCEPHALA, Fauv. l.c. p. 293. Hatam, New Guinea.
94 QUADRA, Fauv. l.c. p. 290. Hatam, New Guinea.
95 VARIOLOSA, Fauv. l.c. p. 292. Hatam and Key Island.

MYLLÆNA. Erichson.

- 96 PAPUANA, Fauv. Ann. Mus. Genov. XII. 1878, p. 288.
Hatam, New Guinea.

COENONICA. Kraatz.

- 97 PUNCTICOLLIS, Kraatz, Linn. Ent. 1857, p. 46; Fauvel, Ann.
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TACHYUSA. Erichson.

- 98 DIVISA, Fauv. Ann. Mus. Genov. XV. 1879-80, p. 115.
Dorey, New Guinea.
99 THORACICA, Fauv. l.c. p. 116. Fly River, New Guinea.
100 USTA, Fauv. l.c. p. 115. Dorey, New Guinea.

SILUSA. Erichson.

- 101 PAPUANA, Fauv. Ann. Mus. Genov. XV. 1879-80, p. 117.
Fly River, New Guinea.

CILEA. Jacq. Duval.

- 102 ALUTACEA, Fauv. Ann. Mus. Genov. XII. 1878, p. 284.
New Guinea and Aru.
103 ANGUSTA, Fauv. l.c. p. 281. New Guinea and Salwatty.
104 ANTENNARIA, Fauv. l.c. p. 285. Salwatty.
105 ASPERA, Fauv. l.c. XV. 1879-80, p. 107.
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106 BASICORNIS, Fauv. l.c. XII. 1878, p. 280.
Hatam, &c., New Guinea.
107 CLAVICORNIS, Fauv. l.c. XII. 1878, p. 283.
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108 CURTICORNIS, Fauv. l.c. p. 281. Hatam, New Guinea.
109 DIMIDIATA, Fauv. l.c. p. 282. Yule Island, New Guinea.
110 GLABRA, Fauv. l.c. p. 285. New Guinea.
111 LÆVIUSCULA, Fauv. l.c. p. 280. New Guinea and Aru.
112 PARTITA, Fauv. l.c. XV. 1879-80, p. 108.
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113 RUGOSELLA, Fauv. l.c. XII. 1878, p. 279.
Hatam and Andai, New Guinea.
114 SPECULUM, Fauv. l.c. p. 283. Vandamen, New Guinea.
115 SUBDEPRESSA, Kraatz, Wieg. Arch. 1859, I. p. 57; Fauv.
Ann. Mus. Genov. XII. 1878, p. 284.
Andai, New Guinea.

TACHINODERUS. Motschulsky.

- 116 ALUTACEUS, Fauv. Ann. Mus. Genov. XII. 1878, p. 277.
New Guinea and Aru.

CONURUS. Stephens.

- 117 LÆVICEPS, Fauv. Ann. Mus. Genov. XV. 1879-80, p. 110.
Fly River, New Guinea.
118 OCELLARIUS, Fauv. l.c. p. 109. Mysol.

QUEDIUS. Stephens.

- 119 CHALCEIVENTRIS, Fauv. Ann. Mus. Genov. XII. 1878, p. 275.
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120 CYANEO-RUFUS, Fauv. l.c. p. 274, t. 2, f. 35.
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121 SPLENDIDUS, Fauv. l.c. p. 273. Hatam, New Guinea.

ACTINUS. Fauvel.

- 122 IMPERIALIS, Fauv. Ann. Mus. Genov. XII. 1878, p. 250, t. 2,
f. 27. Fly River, New Guinea.

LEUCITUS. Fauvel.

- 123 ARGYREUS, Fauv. Ann. Mus. Genov. XII. 1878, p. 254, t. 2,
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124 PARADISEUS, Fauv. l.c. XV. 1879-80, p. 96.
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MYSOLIUS. Fauvel.

- 125 AURICHALCEUS, Fauv. Ann. Mus. Genov. XII. 1878, p. 256,
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PHILONTHUS. Curtis.

- 126 ALBERTISI, Fauv. Ann. Mus. Genov. XII. 1878, p. 260, t. 2,
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127 AUROSCUTATUS, Fauv. l.c. p. 261. Hatam, New Guinea.
128 BECCARII, Fauv. l.c. p. 262, t. 2, f. 32. Dorey, Aru, &c.
129 CINGULATUS, Fauv. l.c. p. 259, t. 2, f. 30.
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- 130 DISCIPENNIS, Fauv. l.c. XV. 1879-80, p. 100.
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- 131 DORIÆ, Fauv. l.c. XII. 1878, p. 262, t. 2, f. 33.
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- 132 ERYTHROPUS, Kraatz, Wieg. Arch. 1859, I. p. 88 ; Fauv.
Ann. Mus. Genov. XV. 1879-80, p. 104. New Guinea.
- 133 GESTROI, Fauv. l.c. XII. 1878, p. 263. Andai, New Guinea.
- 134 HUMERALIS, Fauv. l.c. p. 267. New Guinea, Aru.
- 135 INCLITUS, Fauv. l.c. p. 264. Aru.
- 136 LONGICEPS, Fauv. l.c. XV. 1879-80, p. 104.
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- 137 OCCIPITALIS, Fauv. l.c. p. 103. Fly River, New Guinea.
- 138 PICICORNIS, Guér. Voy. Coquille, Zool. II. p. 62, t. 1, f. 21,
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- 139 PICTICOLLIS, Fauv. l.c. XV. 1879-80, p. 102.
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- 140 QUADRICOLOR, Fauv. l.c. p. 99. Amberbaki, New Guinea.
- 141 RUFITHORAX, Fauv. l.c. XII. 1878, p. 264. New Guinea.
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- 145 SQUALIDUS, Fauv. l.c. XV. 1879-80, p. 105. New Guinea.
- 146 STENOIDES, Grav. Mon. p. 90 ; Kraatz, Wieg. Arch. 1859,
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- 147 TETRAMERUS, Fauv. l.c. p. 265. Hatam, New Guinea.
- 148 THERMATUM, Aubé, Ann. Soc. Ent. Fr. 1850, p. 316 ; Fauv.
Ann. Mus. Genov. XII. 1878, p. 268.
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CAFIUS. Stephens.

- 149 DENSIVENTRIS, Fauv. Ann. Mus. Genov. X. 1877, p. 258. Aru.

EMUS. Curtis.

- 150 ALBERTISI, Fauv. Ann. Mus. Genov. XV. 1879-80, p. 95.
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BELONUCHUS. Nordmann.

- 151 ÆNEIVENTRIS, Fauv. Ann. Mus. Genov. XII. 1878, p. 270.
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154 LIVIDIPIES, Fauv. l.c. p. 271. Andai, New Guinea.

LEPTOMICRUS. Fauvel.

- 155 TEREDO, Fauv. Ann. Mus. Genov. XII. 1878, p. 241.
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PACHYCORYNUS. Motschulsky.

- 156 ANALIS, Fauv. Ann. Mus. Genov. XII. 1878, p. 240.
New Guinea and Salwatty.
157 DIMIDIATUS, Mots. Bull. Mosc. III. 1858, p. 204; Fauv. Ann.
Mus. Genov. XII. 1878, p. 239. Aru.

LEPTACINUS. Erichson.

- 158 PAPUENSIS, Fauv. Ann. Mus. Genov. XII. 1878, p. 242.
New Guinea and Salwatty.

XANTHOLINUS. Serville.

- 159 ALBERTISI, Fauv. Ann. Mus. Genov. X. 1877, p. 246, t. 1,
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160 AURICEPS, Fauv. l.c. p. 244. Hatam, New Guinea.
161 HOLOMELAS, Perroud, Ann. Soc. Linn. Lyon, XI. 1864, p. 84;
Fauv. Ann. Soc. Ent. Fr. 1874, p. 436; Fauv. Ann. Mus.
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162 LORQUINI, Fauv. Ann. Mus. Genov. XII. 1878, p. 245, t. 1,
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LITHOCHARIS. Lacordaire.

- 163 ANNULOSA, Fauv. Ann. Mus. Genov. X. 1877, p. 220 ; XII.
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- 164 CINCTA, Fauv. Ann. Mus. Genov. X. 1877, p. 222.
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- 165 GIGANTEA, Fauv. l.c. XII. 1878, p. 230.
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- 166 HIRTA, Fauv. l.c. p. 231. Hatam, New Guinea.
- 167 IMMANIS, Fauv. l.c. XV. 1879-80, p. 87.
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- 170 PARVISTRIA, Fauv. l.c. p. 233. Hatam, New Guinea.
- 171 PARVICOLLIS, Fauv. l.c. p. 232. Yule Island, New Guinea.

THINOCHARIS. Kraatz.

- 172 BREVICORNIS, Fauv. Ann. Mus. Genov. XII. 1878, p. 228.
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- 173 NIGRELLA, Fauv. l.c. p. 227. New Guinea and Salwatty.

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- 174 RUFUS, Fauv. Ann. Mus. Genov. XV. 1879-80, p. 85.
Dorey, New Guinea.
- 175 STRIGICEPS, Fauv. l.c. p. 84. Dorey, New Guinea.

STILICUS. Latreille.

- 176 HIEROGLYPHICUS, Fauv. Ann. Mus. Genov. XV. 1879-80,
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PÆDERUS. Fabricius.

- 177 ALBERTISI, Fauv. Ann. Mus. Genov. XII. 1878, p. 236, t. 1,
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- 178 COMBUSTUS, Fauv. l.c. XV. 1879-80, p. 88.
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 183 POLITUS, Fauv. l.c. p. 237. Hatam, New Guinea.

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- 184 LUCIDIPIES, Fauv. Ann. Mus. Genov. XV. 1879-80, p. 92.
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 185 SQUALIDIPIES, Fauv. l.c. p. 91. Fly River, New Guinea.

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- 186 LIMBIFER, Fauv. Ann. Mus. Genov. XV. 1879-80, p. 82.
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 187 NOVÆ-GUINÆ, Fauv. .c. XII. 1878, p. 225.
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- 188 CAVICEPS, Fauv. Ann. Mus. Genov. X. 1877, p. 207; XII.
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 189 CŒLESTIS, Fauv. l.c. XII. 1879, p. 224.
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 190 PRISMALIS, Fauv. l.c. p. 222, t. 1, f. 19.
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- 191 LATIPENNIS, Fauv. Ann. Mus. Genov. XV. 1879-80, p. 81.
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 192 PAPUENSIS, Fauv. l.c. p. 81. Dorey, New Guinea.

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- 193 POLYPORUM, Fauv. Ann. Mus. Genov. XII. 1878, p. 213,
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- 194 CARINELLUS, Fauv. Ann. Mus. Genov. XII. 1878, p. 211.
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- 200 CLAVICORNIS, Fauv. Ann. Mus. Genov. XII. 1878, p. 219.
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- 204 SPINIFER, Fauv. l.c. p. 216. Hatam, New Guinea.

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- 205 MINUSCULUS, Fauv. Ann. Mus. Genov. XV. 1879-80, p. 79.
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- 206 ALBERTISI, Fauv. Ann. Mus. Genov. XII. 1878, p. 188, t. 1,
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- 209 BECCARII, Fauv. l.c. p. 191, t. 1, f. 9. Aru and New Guinea.
- 210 BIFURCATUS, Fauv. l.c. XV. 1879-80, p. 74.
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- 248 DENTICOLLIS, Raff. Rev. d'Ent. I. 1882, p. 51. New Guinea.
 249 FEMORALIS, Raff. l.c. p. 51. New Guinea.
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- 251 CAPITATA, Raff. Rev. d'Ent. I. 1882, p. 28. New Guinea.

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- 252 PAPUANUS, Raff. Rev. d'Ent. I. 1882, p. 11. New Guinea.

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- 253 ELEVATUS, Raff. Rev. d'Ent. I. 1882, p. 29. New Guinea.

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- 254 DOREIANUS, Westw. l.c. p. 128. New Guinea.
 255 GLABRICOLLIS, Westw. Trans. Ent. Soc. Lond. 1870, p. 127.
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 256 NITIDUS, Schauf. Ann. Soc. Ent. Fr. (6) II. 1882, p. 44.
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- 257 GESTROI, Schauf. Ann. Mus. Genov. XVIII. 1883, p. 374.
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 258 HATAMENSIS, Schauf. l.c. p. 397. Hatam, New Guinea.
 259 PALLIDUS, Raff. Rev. d'Ent. I. 1882, p. 74. New Guinea.
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 261 PUNCTATISSIMUS, Raff. l.c. p. 60. New Guinea.
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- 265 LONGIPENNIS, Raff. Rev. d'Ent. I. 1882 p. 37. New Guinea.
 266 LUCIDA, Raff. l.c. p. 37. New Guinea.
 267 PAPUANA, Raff. l.c. p. 34. New Guinea.
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 Aru.
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 281 EXPLICATIONIS, Schauf. l.c. p. 418. New Guinea.
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 285 TRICOLOR, Schauf. l.c. p. 407. Hatam, New Guinea.
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NECRODES. Leach.

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PLÆSIUS. Erichson.

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- 360 BIGUTATTUS, Motsch. Etud. Ent. 1858, p. 43
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- 363 OVALIS, Murray, Mon. 1864, p. 403. New Guinea.

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- 395 *MORIO*, Pascoe, Journ. of Ent. II. 1863, p. 142. Mysol.

CERYLON. Latreille,

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HECTARTHURUM. Newman.

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INO. Castelnau.

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- 402 *FASCIIPENNIS*, Fairm. Ann. Ent. Belg. XXVII. 1883 (2)
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t. 7, f. 14. Aru.

- 408 DORSALIS, Grouv. l.c. p. 285, t. 7, f. 12.
Aru; Salwatty; New Guinea.

- 409 GESTROI, Grouv. l.c. p. 281, t. 7, f. 8.
Fly River, New Guinea.

- 410 HUMERALIS, Grouv. l.c. p. 283, t. 7, f. 10.
Aru; Salwatty; New Guinea.

- 411 NEGLECTUS, Grouv. l.c. p. 282, t. 7, f. 9.
Yule Island, New Guinea.

- 412 SUBGRANULATUS, Grouv. l.c. p. 284.
Yule Island, New Guinea.

- 413 SUBTESTACEUS, Grouv. l.c. p. 284, t. 7, f. 11.
Jobie; New Guinea.

PSAMMŒCUS. Latreille.

- 414 BIANGULATUS, Grouv. Ann. Mus. Genov. XVIII. 1883,
p. 291, t. 7, f. 22. Hatam, New Guinea.

- 415 DENTATUS, Grouv. l.c. p. 290, t. 7, f. 20.
Hatam, New Guinea.

SILVANUS. Latreille.

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CATHARTUS. Reiche.

- 417 RUGOSUS, Grouv. Ann. Mus. Genov. XVIII. 1883, p. 295,
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New Guinea.

Family DERMESTIDÆ.

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Family LUCANIDÆ.

LAMPRIMA. Latreille.

- 420 FULGIDA, Boisd. Voy. Astrol. Col. p. 231; Burm. Handb. V.
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- 426 CORANUS, Gestro, Ann. Mus. Genov. XVI. 1880-81, p. 321,
fig. New Guinea.
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GNAPHALORYX. Burmeister.

- 431 APER, Gestro, Ann. Mus. Genov. XVI. 1880-81, p. 324, fig.
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Fly River, New Guinea.

FIGULUS. W. S. Macleay.

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Key Island; Fly River, New Guinea.
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CARDANUS. Westwood.

- 448 ALFURUS, Gestro, Ann. Mus. Genov. IX. 1877, p. 339.
Andai, New Guinea.

TRICHOSTIGMUS. Kaup.

- 449 GLABER, Kirsch, MT. Mus. Dresd. Heft II. 1877, p. 139.
Jobi.

MASTOCHILUS. Kaup.

- 450 OBLIQUUS, Kirsch, MT. Mus. Dresd. Heft II. 1877, p. 140.

LEPTAULAX. Kaup.

- 451 DENTATUS, Weber, Obs. Ent. I. p. 82.
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ERIOCNEMIS. Kaup.

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New Britain; Dorey, New Guinea.

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Heft III. p. 24. New Guinea.

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ACERAIUS. Kaup.

- 455 PELTOSTICTUS, Kaup, Col. Hefte, IV. 1868, p. 5. Aru.

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Family SCARABÆIDÆ.

TESSERODON. Hope.

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Fly River, New Guinea.

TEMNOPECTRON. Westwood.

- 458 ÆNEOLUM, Lansb. Ann. Mus. Genov. (2) II. 1885, p. 375.
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COPTODACTYLA. Burmeister.

- 459 PAPUA, Lansb. Ann. Mus. Genov. (2) II. 1885, p. 393.
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ONITIS. Fabricius.

- 460 CORYDON, Boisd. Voy. Astrol. Col. p. 154; Dej. Cat. 3 ed.
p. 159. New Guinea.

ONTHOPHAGUS. Latreille.

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- 650 NIGROVIOLACEA, Deyr. Ann. Ent. Belg. VIII. 1864, p. 106.
New Guinea.

CISSEIS. Castelnau et Gory.

- 651 AURICEPS, Deyr. Ann. Ent. Belg. VIII. 1864, p. 117.
New Guinea.
- 652 BRACHYFORMIS, Deyr. l.c. p. 117. Mysol.
- 653 DIMIDIATUS, MacL. Proc. Linn. Soc. N.S.W. (2) I. 1886,
p. 148. Fly River, New Guinea.

CORÆBUS. Castelnau et Gory.

- 654 ÆNEIFRONS, Deyr. Ann. Ent. Belg. VIII. 1864, p. 117.
Mysol.
- 655 CUPRICOLLIS, Deyr. l.c. p. 124. Dorey, New Guinea.
- 656 NIGRO-CÆRULEUS, l.c. p. 133, t. 3, f. 4. Waigiou.

SAMBUS. Deyrolle.

- 657 ARGENTATUS, Gestro, Ann. Mus. Genov. IX. 1877, p. 358.
Ramoi, New Guinea.
- 658 GAUTIERI, Deyr. Ann. Ent. Belg. VIII. 1864, p. 214.
Waigiou
- 659 VERMICULATUS, Deyr. l.c. p. 215. Dorey, New Guinea.

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New Britain.

- 661 AMETHYSTICOLLIS, Deyr. l.c. p. 192. Dorey, New Guinea.
 662 ANTHRACINUS, Deyr. l.c. p. 106. Mysol.
 663 AURATUS, Deyr. l.c. p. 209. Aru.
 664 AURIPES, Deyr. l.c. p. 180 Mysol.
 665 CHALYBEUS, Deyr. l.c. p. 193. Dorey, New Guinea.
 666 CONCAVUS, Deyr. l.c. p. 203. New Guinea.
 667 CUNEIFORMIS, Deyr. l.c. p. 187. Mysol.
 668 DORSALIS, Deyr. l.c. p. 180. Mysol.
 669 ELONGATUS, Deyr. l.c. p. 151. New Guinea.
 670 FUNEBRIS, Deyr. l.c. p. 188. New Guinea.
 671 HIRSUTULUS, Deyr. l.c. p. 210. Waigiou.
 672 INDIGACEUS, Deyr. l.c. p. 161. New Guinea.
 673 NIGERRIMUS, Deyr. l.c. p. 204. Mysol.
 674 NIGROÆNEUS, Deyr. l.c. p. 176. Waigiou.
 675 NIGROVIOLACEUS, Deyr. l.c. p. 195. Waigiou.
 676 OLYMPICUS, Deyr. l.c. p. 183. Mysol.
 677 ORNATUS, Deyr. l.c. p. 155. Duke of York Island.
 678 PINII, Gestro, Ann. Mus. Genov. IX. 1877, p. 360. New Guinea.
 679 PUNCTIFRONS, Deyr. l.c. p. 149. Mysol.
 680 PAPUANUS, Gestro, Ann. Mus. Genov. IX. 1877, p. 360.
 New Guinea.
 681 SPINIPES, Deyr. l.c. p. 153. Mysol.
 682 ROROENSIS, Gestro, Ann. Mus. Genov. IX. 1877, p. 359.
 Yule Island, New Guinea.
 683 SUBTRIFASCIATUS, Deyr. l.c. p. 191. New Guinea.
 684 SYLVESTRIS, Deyr. l.c. p. 206. Mysol.
 685 TRICOLOR, Deyr. l.c. p. 194. Mysol.
 686 VULCANUS, Deyr. l.c. p. 179. Mysol.

ANTHAXOMORPHUS. Deyrolle.

- 687 FEMORALIS, Deyr. Ann. Ent. Belg. VIII. 1864, p. 222.
 Key Island.

688 PAPUANUS, Deyr. l.c. p. 221. Dorey, New Guinea.

APHANISTICUS. Latreille.

689 DIABOLICUS, Deyr. Ann. Ent. Belg. VIII. 1864, p. 225.
New Guinea.

690 IMPRESSICOLLIS, Deyr. l.c. p. 224. New Guinea.

ENDELUS. Deyrolle.

691 APICALIS, Deyr. Ann. Ent. Belg. VIII. 1864, p. 233.
New Guinea.

692 INTERMEDIUS, Deyr. l.c. p. 234. Mysol.

TRACHYS. Fabricius.

693 ALBOGRAPHIA, Deyr. Ann. Ent. Belg. VIII. 1864, p. 249.
Aru.

694 AZUREA, Deyr. l.c. p. 247. Mysol.

695 CARINATA, Deyr. l.c. p. 248. New Guinea.

696 CONFUSA, Deyr. l.c. p. 263. Mysol.

697 DECORATA, Deyr. l.c. p. 259. Salwatty.

698 HUMILIS, Deyr. l.c. p. 266. New Guinea.

699 NUBILA, Deyr. l.c. p. 254. Mysol.

700 PARALLELICOLLIS, Deyr. l.c. p. 267. Mysol.

701 SETOSULA, Deyr. l.c. p. 254. New Guinea.

702 ZEBRINA, Deyr. l.c. p. 253. Mysol.

Family EUCNEMIDÆ.

ARISUS. Bonvouloir.

703 ATRIPENNIS, Macl. Proc. Linn. Soc. N.S.W. IX. 1884, p. 703.
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DROMÆOLUS. Kiesenwetter.

704 FERRUGINIPES, Bonv. Mon. Ann. Fr. 1870, p. 208, t. 9, f. 7.
Waigiou.

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705 SEMIGRISEUS, Bonv. l.c. p. 238, t. 10, f. 7.

Dorey, New Guinea.

706 TIBIALIS, Bonv. l.c. p. 215, t. 8, f. 8.

Aru.

FORNAX. Castelnau.

707 ADNEXUS, Bonv. Mon. Ann. Fr. 1870, p. 359, t. 17, f. 2.

New Guinea.

708 ATER, Bonv. l.c. p. 312, t. 13, f. 4-5.

New Guinea.

709 COSTULATUS, Bonv. l.c. t. 20, f. 5.

Mysol.

710 LATUS, Bonv. l.c. p. 325, t. 14, f. 6.

Aru.

711 LINEATUS, Bonv. l.c. p. 403, t. 20, f. 2.

New Guinea.

712 MYSOLENSIS, Bonv. l.c. p. 364, t. 17, f. 5.

Mysol.

713 PICTUS, Bonv. l.c. p. 317, t. 13, f. 9. Dorey, New Guinea.

714 PLANUS, Bonv. l.c. p. 410, t. 20, f. 6.

Waigiou.

715 SEPONENDUS, Bonv. l.c. p. 330.

Mysol.

716 SUBACUMINATUS, Bonv. l.c. p. 346, t. 15, f. 8.

Dorey, New Guinea.

SCYTHON. Castelnau.

717 BICOLOR, Casteln. Silb. Rev. III. 1835, p. 170; Bonv. l.c. p. 499, t. 25, f. 1.

melanopterus, Boisd. Voy. Astrol. II. p. 102, t. 6, f. 9.

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718 NIGRIVENTRIS, Bonv. l.c. p. 496, t. 24, f. 8.

Mysol.

MELANOCOLEUS. Bonvouloir.

719 GROSSUS, Bonv. Mon. Ann. Fr. 1870, p. 507, t. 25, f. 5.

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MICRORRHAGUS. Eschscholtz.

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Mysol.

721 DERELICTUS, Bonv. l.c. p. 544, t. 26, f. 2.

Dorey, New Guinea.

722 FLABELLATUS, Bonv. l.c. p. 582, t. 28, f. 3.

New Guinea.

723 PICTURATUS, Bonv. l.c. p. 572, t. 27, f. 7.

Mysol.

724 RUGOSIPENNIS, Bonv. l.c. p. 569, t. 2, f. 4. Mysol.

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HYLOTASTES. Bonvouloir.

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New Guinea.

HYPOCOELUS. Eschscholtz.

727 ASPERATUS, Bonv. Mon. Ann. Fr. 1870, p. 701, t. 34, f. 1.

Aru.

HETEROTAXIS. Bonvouloir.

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Mysol.

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Dorey, New Guinea.

ARGANUS. Bonvouloir.

730 DISTINCTUS, Bonv. Mon. Ann. Fr. 1871, p. 159. Mysol.

CAFOLUS. Bonvouloir.

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l.c. p. 811, t. 39, f. 3. Fly River, &c., New Guinea.

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AGRYPNUS. Eschscholtz,

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New Guinea.

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New Guinea.

LACON. Castelnau.

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Yule Island, New Guinea.

739 *CINERASCENS*, Candz. l.c. p. 103. Yule Island, New Guinea.

740 *IMPRESSUS*, Candz. l.c. p. 102. New Guinea.

741 *LAXUS*, Candz. Mém. Liège, (2) IV. 1874, p. 143. Mysol.

742 *LIMOSUS*, Candz. l.c. (2) IX. 1882, p. 10. New Guinea.

743 *SUBSERICEUS*, Candz. Ann. Mus. Genov. XII. 1878, p. 102.

New Guinea.

744 *TRISTIS*, Blanch. Voy. Pole Sud, Zool. p. 86, t. 6, f. 8.

New Guinea.

ALAUUS. Eschscholtz.

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Yule Island, New Guinea.

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Mount Arfak, New Guinea.

748 *BITUBEROSUS*, Fairm. Le Nat. III. 1881, p. 381; Ann. Ent.

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New Guinea.

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- 757 CINNAMOMBUS, Boisd. Voy. Astrol. Col. p. 106; Candz. Mon.
II. p. 170, t. 3, f. 18. Duke of York Island.
- 758 FASCIOLATUS, Fairm. Le Nat. V. 1883, p. 238. New Britain.
- 759 TERTIUS, Candz. Mém. Liège, (2) IX. 1882, p. 44.
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Aru.
- 761 CONTIGUUS, Candz. l.c. p. 114. New Guinea.
- 762 CORNICULATUS, Candz. l.c. p. 113. Ramoi, New Guinea.
- 763 CRISTATUS, Candz. l.c. XV. 1880. p. 190. New Guinea.
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- 765 MUCRONATUS, Candz. l.c. p. 110. Hatam, New Guinea.
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- 768 UMBRACULATUS, Candz. Mém. Belg. XVII. 1865, p. 25.
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- 770 PUSILLUS, Candz. Mém. Belg. XVII. 1865, p. 26.
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- 771 ALBERTISI, Candz. Ann. Mus. Genov. XV. 1880, p. 191.
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- 773 NITIDULUS, Candz. Ann. Mus. Genov. XII. 1878, p. 119.
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- 775 AGRIOTIDES, Candz. Mém. Belg. XVII. 1865, p. 31.
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MELANOXANTHUS. Eschscholtz.

- 779 ANGULATUS, Candz. Ann. Mus. Genov. XII. 1878, p. 129.
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Mon. II. p. 512, t. 7, f. 12. Duke of York Island.
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CRYPTOHYPNUS. Eschscholtz.

- 783 SUTURALIS, Candz. Ann. Mus. Genov. XII. 1878, p. 131.
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CARDIOPHORUS. Eschscholtz.

- 784 PAPUENSIS, Candz. Ann. Mus. Genov. XII. 1878, p. 132.
Yule Island, New Guinea.

MELANOTUS. Eschscholtz.

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Andai, New Guinea.
786 ALBERTISI, Candz. l.c. p. 135.
Dorey, Hatam, &c., &c., New Guinea.

OXYSTETHUS. Fairmaire.

- 787 SCAPULATUS, Fairm. Le Nat. V. 1883, p. 238. New Britain.

HAPATESUS. Candèze.

- 788 HIRTELLUS, Candz. Mém. Liège, (2) IX. 1882, p. 98.
New Guinea.

LUDIIUS. Latreille.

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791 VARIEGATUS, Candz. l.c. p. cxci. Aru.

AGRIOTES. Eschscholtz.

792 AUSTRALASIÆ, Blanch. Voy. Pole Sud, IV. p. 90, t. 6, f. 11.
Aru.

TETRIGUS. Candèze.

793 PEXUS, Candz. Mém. Liège, (2) IV. 1874, p. 157.
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AGONISCHIUS. Candèze.

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Family RHIPIDOCERIDÆ.

CALLIRRHIPIS. Latreille.

795 CASTANEA, Blanch. Voy. Pole Sud, IV. p. 81, t. 6, f. 5.
New Guinea.796 PICEIVENTRIS, Fairm. Ann. Ent. Belg. XXVII. 1883, (2)
p. 18. Duke of York Island.

Family MALACODERMIDÆ.

LYCUS. Fabricius.

797 DEPLANATUS, Waterh. Trans. Ent. Soc. Lond. 1878, p. 109.
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798 LUTEOLUS, Waterh. l.c. p. 113. Aru.

METRIORRHYNCHUS. Guérin.

799 ANGUSTULUS, Waterh. Ill. Coll. Brit. Mus. I. 1879, p. 57,
t. 14, f. 5. Dorey, New Guinea.

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- 800 ATER, Waterh. l.c. p. 57, t. 14, f. 7.
Aru ; Dorey, New Guinea.
- 801 DILUTUS, Waterh. l.c. p. 58. t. XIV, f. 6. Mysol.
- 802 DOLESCHALI, Redt. Iteis. Novar. II. p. 101, t. 3, f. 12.
Duke of York Island.
- 803 EPHIPPIGER, Guér. Voy. Coquille, 1830, p. 73 ; Boisd. Voy.
Astrol. II. p. 117. New Guinea.
- 804 FLAVOLATERALIS, Waterh. Ill. Coll. Brit. Mus. I. 1879, p. 56,
t. 114, f. 4. Aru.
- 805 FUNESTUS, Guér. l.c. p. 73 ; Boisd. l.c. p. 117. New Guinea.
- 806 IMMERSUS, Waterh. Ill. Coll. Brit. Mus. I. 1879, p. 53, t. 13.
f. 1. New Guinea.
- 807 INFUSCATUS, Macl. Proc. Linn. Soc. N.S.W. (2) I. 1886,
p. 151. Fly River, New Guinea.
- 808 NOBILIS, Waterh. Ill. Coll. Brit. Mus. I. 1879, p. 54, t. 13,
f. 3. New Guinea.
- 809 PAPUENSIS, Macl. Proc. Linn. Soc. N.S.W. IX. 1884, p. 704.
Maclay Coast, New Guinea.
- 810 PARALLELUS, Guér. Voy. Coquille, 1830, p. 72 ; Boisd. Voy.
Astrol. II. p. 114. Fly River, &c., New Guinea.
- 811 PUNCTICOLLIS, Waterh. Ill. Coll. Brit. Mus. I. 1879, p. 57,
t. 14, f. 3. Dorey.
- 812 RUSTICUS, Waterh. l.c. p. 51, t. 13, f. 2. Mysol.
- 813 SERRICORNIS, Macl. Proc. Linn. Soc. N.S.W. (2) I. 1866,
p. 150. Fly River, New Guinea.
- 814 TENUIS, Macl. l.c. p. 150. Fly River, New Guinea.
- 815 THORACICUS, Fabr. Syst. El. II. p. 117 ; Boisd. Voy. Astrol.
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- DITUA. Waterhouse.
- 816 DEPLANATA, Waterh. Ill. Coll. Brit. Mus. I. 1879, p. 34, t. 8,
f. 8. Dorey, New Guinea.
- XYLOBANUS. Waterhouse.
- 817 MIXTUS, Waterh. Ill. Coll. Brit. Mus. I. 1879, p. 43, t. 11,
f. 5. Waigiou.

818 *OBSCURUS*, Macl. Proc. Linn. Soc. N.S.W. (2) I. 1886,
p. 151. Fly River, New Guinea.

819 *REGULARIS*, Waterh. Ill. Coll. Brit. Mus. I. 1879, p. 41, t. 10,
f. 8. Dorey, New Guinea.

CALOPTERON. Guérin.

820 *AMPLIPENNE*, Macl. Proc. Linn. Soc. N.S.W. (2) I. 1886,
p. 151. Fly River, New Guinea.

821 *DICHROMA*, Boisd. Voy. Astrol. II. p. 123, t. 6, f. 12.
New Guinea.

822 *DORYCUM*, Boisd. l.c. p. 118, t. 9, f. 9; Blanch. Voy. Pole
Sud, IV. p. 77, t. 5, f. 9. New Guinea.

823 *FLAVICANS*, Blanch. l.c. p. 76, t. 5, f. 13.
Aru; Fly River, New Guinea.

824 *RUFOSTERNALE*, Blanch. l.c. p. 76, t. 5, f. 11. New Guinea.

CLADOPHORUS. Guérin.

825 *ABERRANS*, Waterh. Ill. Coll. Brit. Mus. I. 1879, p. 65, t. 14,
f. 3. Aru.

826 *APICALIS*, Macl. Proc. Linn. Soc. N.S.W. (2) I. 1886, p. 152.
Fly River, New Guinea.

827 *CINCTUS*, Fabr. Syst. El. II. p. 113; Boisd. Voy. Astrol. II.
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suturalis, Guér. Voy. Coquille, Ent. p. 73. New Guinea.

828 *COLLARIS*, Guér. l.c. p. 73; Boisd. l.c. p. 121. New Guinea.

829 *DETRACTUS*, Waterh. Ill. Coll. Brit. Mus. I. 1879, p. 64,
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830 *FORMOSUS*, Guér. Voy. Coquille, Ent. p. 73; Boisd. Voy.
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dimidiatus, Guér. l.c. t. 2, f. 9. New Guinea.

831 *FUSCATUS*, Waterh. Ill. Coll. Brit. Mus. I. 1879, p. 64,
t. 16, f. 6. Waigiou.

832 *INGENUUS*, Waterh. l.c. p. 64, t. 16, f. 2. Fly River, Dorey.

833 *LONGICORNIS*, Macl. Proc. Linn. Soc. N.S.W. (2) I. 1886,
p. 152. Fly River.

834 *NIGRESCENS*, Macl. l.c. p. 152. Fly River.

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835 NIGRICEPS, Kirsch. MT. Mus. Dresd. Heft II. 1877, p. 143.
New Guinea.

836 OCHRACEICOLLIS, Fairm. Ann. Ent. Belg. XXVII. 1883, (2)
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837 ORNATUS, Waterh. Ill. Coll. Brit. Mus. I. 1879, p. 65, t. 16,
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838 RESTRICTUS, Waterh. l.c. p. 66, t. 16, f. 5. Waigiou.

839 RUFICOLLIS, Guér. Voy. Coquille, Ent. p. 73, t. 2, f. 8.
New Guinea.

crocicollis, Boisd. Voy. Astrol. II. p. 116. New Guinea.

840 SEMIRUFUS, Macl. Proc. Linn. Soc. N.S.W. (2) 1886, p. 152.
Fly River.

CALOCHROMUS. Guérin.

841 DISTINGUENDUS, Fairm. Ann. Ent. Belg. XXVII. 1883, (2)
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842 GLAUOPTERUS, Guér. Ann. Fr. 1833, p. 159, t. 7, B. f. 1-5.
New Guinea.

ENICLASES. C. O. Waterhouse.

843 LUTEOLUS, Waterh. Ill. Coll. Brit. Mus. I. 1879, p. 66,
t. 16, f. 12. Aru.

TRICHALUS. Waterhouse.

844 ACUTANGULUS, Waterh. Trans. Ent. Soc. Lond. 1878, p. 114 ;
Ill. Coll. Brit. Mus. I. 1879, p. 68, t. 17, f. 1. Dorey.

845 ÆMULUS, Waterh. l.c. p. 114 ; l.c. p. 69, t. 16, f. 9. Aru.

846 APICALIS, Macl. Proc. Linn. Soc. N.S.W. (2) I. p. 152.
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847 DETRACTUS, Waterh. Ill. Coll. Brit. Mus. I. 1879, p. 70,
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848 GRISEUS, Waterh. l.c. p. 69, t. 17, f. 3. Dorey.

849 NIGRESCENS, Waterh. l.c. p. 70, t. 17, f. 4. Mysol.

850 PALLIDIPENNIS, Macl. Proc. Linn. Soc. N.S.W. (2) I. 1886,
p. 152. Fly River.

851 PERTURBATUS, Waterh. Ill. Coll. Brit. Mus. I. 1879, p. 70,
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ENYLUS. Waterhouse.

- 852 SEGREGATUS, Waterh. Ill. Coll. Brit. Mus. I. 1879, p. 72,
t. 17, f. 10. Mysol.

STROPHICUS. Waterhouse.

- 853 NIGELLUS, Waterh. Ill. Coll. Brit. Mus. I. 1879, p. 73,
t. 17, f. 11. Mysol.

LUCIOLA. Castelnau.

- 854 ANTENNATA, Ern. Oliv. Ann. Mus. Genov. (2) II. 1885.
p. 365, t. 5, f. 8. Fly River.

- 855 ANTHRACINA, Ern. Oliv. l.c. p. 368. Yule Island.

- 856 AUSTRALIS, Fabr. Syst. Ent. p. 201 ; Boisd. Voy. Astrol. II.
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Guérini, Casteln. Essai, p. 151, nota.

- 857 MICROTHORAX, Ern. Oliv. Ann. Mus. Genov. (2) II. 1885,
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- 858 RUFICOLLIS, Guér. Voy. Coquille, Ent. p. 75 ; Boisd. Voy.
Astrol. II. p. 128. Dorey, Maclay Coast.

- 859 TARSALIS, Ern. Oliv. Ann. Mus. Genov. (2) II. 1885, p. 360,
t. 5, f. 6. Fly River.

PYROPHANES. Ern. Olivier.

- 860 APPENDICULATA, Ern. Oliv. Ann. Mus. Genov. (2) II. 1885,
p. 369. Ramoi, New Guinea.

- 861 BECCARII, Ern. Oliv. l.c. p. 369, t. 5, f. 12. Aru.

TELEPHORUS. Schäffer.

- 862 ACUTIPENNIS, Guér. Voy. Coquille, p. 75 ; Boisd. Voy. Astrol.
II. p. 132. Fly River, &c.

- 863 BASICORNIS, Fairm. Ann. Ent. Belg. XXVII. 1883, (2) p. 20.
Duke of York Island.

- 864 PRÆUSTUS, Guér. Voy. Coquille, p. 75 ; Boisd. Voy. Astrol.
II. p. 132. New Guinea.

- 865 SCHAFFERI, Guér. l.c. p. 76 ; Boisd. l.c. p. 133. New Guinea.

TYLOCERUS. Dalman.

- 866 ANTENNATUS, Guér. Voy. Coquille, Ent. p. 74, t. 2, f. 6 ;
Macl. Proc. Linn. Soc. N.S.W. (2) I. 1886, p. 153. Fly River.

LAIUS. Guérin.

- 867 CYANEUS, Guér. Voy. Coquille, Ent. p. 78, t. 2, f. 10;
heterocerus, Boisd. Voy. Astrol. II. Col. p. 136.
 New Guinea.

CARPHURUS. Erichson.

- 868 CYANIPENNIS, MacL. Proc. Linn. Soc. N.S.W. (2) I. 1886,
 p. 153. Fly River.
 869 RUBRIVENTRIS, Fairm. Ann. Ent. Belg. XXVII. 1883, (2)
 p. 21. Duke of York Island.
 870 RUBROSEGMENTATUS, Fairm. l.c. p. 20. Duke of York Island.
 871 SERRICORNIS, Fairm. l.c. p. 21. New Britain.

Family CLERIDÆ.

CYLIDRUS. Latreille.

- 872 ALCYONEUS, Pascoe, Journ. of Ent. I. 1860, p. 44.
 New Guinea.
 873 VESCOEI, Fairm. Ann. Ent. Belg. (2) XXVII. 1883, p. 22.
 Duke of York Island.

ALLOCHOTES. Westwood.

- 874 APICALIS, Westw. Trans. Ent. Soc. Lond. 1875, p. 242.
 New Guinea.
 875 CHRYSOMELINA, Westw. l.c. p. 242. Dorey.

ANISOPHYLLUS. Westwood.

- 876 OBSCURUS, Westw. Trans. Ent. Soc. Lond. 1876, p. 494, t. 2,
 f. 1. Mysol.

STIGMATIUM. Gray.

- 877 CINEREUM, Gorham, Trans. Ent. Soc. Lond. 1878, p. 165.
 New Guinea.
 878 NITIDICEPS, Chev. Rev. Mag. Zool. (3) II. 1874, p. 314.
 Dorey.

OMADIUS. Castelnau.

- 879 MUCRONATUS, Kirsch, MT. Mus. Dresd. Heft II. 1877, p. 144.
 Mysol.

- 880 NOVÆGUINEENSIS, Chev. Rev. Mag. Zool. (3) II. 1874, p. 319.
New Guinea.
- 881 PICTIPES, Chev. l.c. p. 319. New Guinea.

TENERUS. Castelnau.

- 882 DIFFICILIS, Gorham, Trans. Ent. Soc. Lond. 1877, p. 407.
New Guinea.
- 883 DOREYANUS, Gorham, l.c. p. 405. New Guinea.
- 884 FRONTALIS, Fairm. Le Nat. III. 1881, p. 389.
Duke of York Island.
- 885 INCERTUS, Gorham, Trans. Ent. Soc. Lond. 1887, p. 408. Aru.
- 886 PERSIMILIS, Gorham, l.c. p. 408. Dorey.

PRIONOPHORUS. Blanchard.

- 887 BICOLOR, Blanch. Voy. Pole Sud, IV. p. 64, t. 5, f. 16.
New Guinea.

Family LYMEXYLONIDÆ.

HYLECÆTUS. Latreille.

- 888 JAVANICUS, Chev. Icon. Règ. Anim. p. 57 ; t. 16, f. 9 ; Fairm.
Notes Leyd. Mus. IX. 1887, p. 155. Andai, New Guinea.

Family BOSTRYCHIDÆ.

RHIZOPERTHA.

- 889 PAPUENSIS, Macl. Proc. Linn. Soc. N.S.W. (2) I. 1886,
p. 154. Fly River.
- 890 RELIGIOSA, Boisd. Voy. Astrol. II. p. 140 ; Fairm. Rev.
Zool. 1850, p. 50. New Britain ; New Guinea, &c.

Family TENEBRIONIDÆ.

OPATRUM. Fabricius.

- 891 HISPIDOCOSTATUM, Fairm. Ann. Ent. Belg. (2) XXVII. 1883,
p. 23. New Britain.

330 CATALOGUE OF THE KNOWN COLEOPTERA OF NEW GUINEA,

BRADYMERUS. Perroud.

- 892 GRANATICOLLIS, Fairm. Ann. Ent. Belg. (2) XXVII. 1883,
p. 23. Duke of York Island.
893 SEMIASPERATUS, Fairm. l.c. p. 24. New Britain.

LEIOCHRINUS. Westwood.

- 894 FULVICOLLIS, Westw. Tijdschr. Ent. XXVI. 1883, p. 70, t. 3,
f. 14. New Guinea.
895 NIGRICORNIS, Westw. l.c. p. 70, t. 5, figs. 1-7, details.
New Guinea.
896 RUFOFULVUS, Westw. l.c. p. 71. Aru.

LEIOCHRODES. Westwood.

- 897 AGATHIDIODES, Westw. Tijdschr. Ent. XXVI. 1883, p. 75. Aru.
898 NIGRIPENNIS, Westw. l.c. p. 72. Dorey, &c.
899 PARVULUS, Westw. l.c. p. 74. Dorey.
900 PICICOLLIS, Westw. l.c. p. 73. Mysol.
901 SUBPURPURASCENS, Westw. l.c. p. 73. Dorey; Aru; Waigiou.

HOPLOCEPHALA. Castelnau et Brullé.

- 902 JANTHINA, Casteln. et Brullé, Ann. Sc. Nat. XXIII. 1831,
p. 343. New Guinea.

CEROPRIA. Castelnau et Brullé.

- 903 INTERMEDIA, Harold, Stett. Ent. Zeit, XXXIX. 1878, p. 354.
New Guinea.
904 METALLICA, Chev. CR. Ent. Belg. XXI. 1878, p. cl.
New Guinea.
905 VIRIDULA, Fairm. Ann. Ent. Belg. (2) XXVII. 1883, p. 24.
New Britain.

TOXICUM. Latreille.

- 906 NUDICORNE, Fairm. Ann. Ent. Belg. XXVII. 1883, (2) p. 24.
Duke of York Island.
907 PICTICOLLE, Bates, Ent. Month. Mag. X. 1873, p. 45.
New Guinea.
908 RUFIPES, Kirsch, MT. Mus. Dresd. Heft II. 1877, p. 145.
New Guinea.

CILIBE. Brême.

- 909 ELONGATA, Brême, Mon. I. p. 38, t. 7, f. 6; Blanch. Voy.
Pole Sud, IV. p. 148, t. 10, f. 4-5. New Guinea.

NYCTOZOILUS. Guérin.

- 910 CRENATICOLLIS, Macl. Proc. Linn. Soc. N.S.W. (2) I. 1886,
p. 154. Fly River.

NYCTOBATES. Guérin.

- 911 ILLÆSICOLLIS, Fairm. Ann. Ent. Belg. XXVII. 1883, (2)
p. 25. Duke of York Island.
912 LOTTINI, Boisd. Voy. Astrol. II. p. 257; Montrouz. Ann.
Soc. Agr. Lyon, 1855, VII. p. 31. New Guinea.
913 PUNCTULATOR, Fairm. Ann. Ent. Belg. XXVII. 1883, (2)
p. 26. Duke of York Island.

ZOPHOPHILUS. Fairmaire.

- 914 CURTICORNIS, Fairm. Le Nat. III. 1880, p. 359; Ann. Ent.
Belg. XXVII. 1883, (2) p. 26. Duke of York Island.

LYPROPS. Hope.

- 915 ATRO-NITENS, Fairm. Ann. Ent. Belg. XXVII. 1883, (2) p. 27.
New Britain.

PROPHANES. Westwood.

- 916 CUPREIPENNIS, Macl. Proc. Linn. Soc. N.S.W. (2) I. 1886,
p. 155. Fly River, New Guinea.
917 SUBMETALLICUS, Macleay, l.c. p. 154.
Fly River, New Guinea

HEMICYCLUS. Westwood.

- 918 DISCICOLLIS, Fairm. Ann. Ent. Belg. XXVII. 1883, (2) p. 27.
Duke of York, Island.

CHARIOTHECA. Pascoe.

- 919 CUPRIPENNIS, Pascoe, Journ. of Ent. I. 1860, p. 126.
New Guinea.
920 IMPRESSICOLLIS (Thesilea), Fairm. Le Nat. I. 1879, p. 70;
Ann. Ent. Belg. XXVII. 1883, (2) p. 28.
Duke of York Island.
921 LITIGIOSA, Pascoe, Journ. of Ent. I. 1860, p. 126. New Guinea.

- 332 CATALOGUE OF THE KNOWN COLEOPTERA OF NEW GUINEA,
- 922 THALASSINA, Fairm. Ann. Ent. Belg. XXVII. 1883, (2) p. 28.
New Britain.
- 923 VIOLACEA, Pascoe, Ann. Nat. Hist. (5) 1887, p. 17.
Dorey.
- AMARYGMUS. Dalman.
- 924 CONVEXIUSCULUS, Macl. Proc. Linn. Soc. N.S.W. (2) I. 1886,
p. 156. Fly River.
- 925 CUPREUS, Guér. Voy. Coquille, II. 1830, p. 102, t. 5, f. 2 ;
Boisd. Voy. Astrol. II. p. 272.
Fly River, &c., New Guinea.
- 926 FOVEO-STRIATUS, Fairm. Journ. Mus. Godeffr. XIV. 1878,
p. 35; Ann. Ent. Belg. XXVII. 1883, (2) p. 29. New Britain.
- 927 FOVEO-SERIATUS, Fairm. Journ. Mus. Godeffr. XIV. 1879,
p. 114. Duke of York Island.
- 928 HAAGII, Kirsch, MT. Mus. Dresd. Heft II. 1877, p. 146.
New Guinea.
- 929 HYDROPHILOIDES, Fairm. Rev. Zool. 1849, p. 450.
Duke of York Island, &c.
- 930 INORNATUS, Macl. Proc. Linn. Soc. N.S.W. (2) I. 1886,
p. 155. Fly River.
- 931 MUTABILIS, Guér. Voy. Coquille, II. p. 101, t. 5, f. 1 ; Boisd.
Voy. Astrol. II. p. 271. New Guinea.
- 932 OCULEUS, Macl. Proc. Linn. Soc. N.S.W. (2) I. 1886, p. 156.
Fly River.
- 933 PAPUENSIS, Macl. l.c. p. 156. Fly River.
- 934 PUNCTICEPS, Macl. l.c. p. 156. Fly River.
- 935 RUFICRUS, Blanch. Voy. Pole Sud, IV. p. 181, t. 12, f. 6.
Aru.
- DIETYSUS. Pascoe.
- 936 ORIENTALIS, Fairm. Ann. Ent. Belg. XXVII. 1883, (2) p. 29.
New Britain.
- STRONGYLUM. Kirby.
- 937 LÆVICOLLE, Kirsch, MT. Mus. Dresd. Heft II. 1877, p. 146.
Jobi.
- 938 NITIDUM, Mäklin, Mon. Act. Fenn. 1864, p. 319.
New Guinea.

- 939 PARALLELUM, Mäklin, l.c. p. 319. New Guinea.
 940 TUBERIPENNE, Fairm. Le Nat. III. 1881, p. 359; Ann. Ent.
 Belg. XXVII. 1883, (2) p. 30. Duke of York Island.

ALLECULA. Fabricius.

- 941 PAPUENSIS, Macl. Proc. Linn. Soc. N.S.W. (2) I. 1886,
 p. 156. Fly River.

Family PYTHIDÆ.

RHINOSIMUS. Latreille.

- 942 WALLACEI, Pascoe, Journ. of Ent. I. 1860, p. 128.
 New Guinea.

Family LAGRIIDÆ.

LAGRIA. Fabricius.

- 943 AUREOPILOSA, Le Guillou, Rev. Zool. 1844, p. 225.
 New Guinea.
 944 AZUREIPENNIS, Macl. Proc. Linn. Soc. N.S.W. (2) I. 1886,
 p. 157. Fly River.
 945 CASTANEA, Guér. Voy. Coquille, II. p. 104, t. 5, f. 6; Boisd.
 Voy. Astrol. II. p. 288. New Guinea.
 946 LONGICOLLIS, Boisd. Voy. Astrol. II. p. 288. New Guinea.
 947 PALLIATA, Macl. Proc. Linn. Soc. N.S.W. (2) I. 1886, p. 157.
 Fly River.
 948 PULCHELLA, Guér. Voy. Coquille, II. p. 104, t. 5, f. 5; Boisd.
 Voy. Astrol. II. p. 288; Blanch. Voy. Pole Sud, IV.
 p. 185, t. 12, f. 11. New Guinea.

Family MORDELLIDÆ.

MORDELLA. Linné.

- 949 DECEMGUTTATA, Fabr. Syst. El. II. p. 123; Boisd. Voy.
 Astrol. II. p. 289. New Guinea.
 950 DURVILLEI, Boisd. l.c. p. 291, t. 7, f. 7. New Guinea.
 951 LEUCOSPILA. Fairm. Ann. Ent. Belg. XXVII. 1883, (2)
 p. 30. Duke of York Island.

952 LOTTINII, Boisd. Voy. Astrol. II. 1835, p. 291. New Guinea.

953 TEXTILIS, Montrouz. Ann. Soc. Agr. Lyon, VII. 1855, p. 34 ;
Fairm. Ann. Ent. Belg. XXVII. 1883, (2) p. 31.

New Britain.

Family RHIPIDOPHORIDÆ.

PELECOTOMOIDES. Castelnau.

954 MURINA, Blanch. Voy. Pole Sud, IV. 1853, p. 187, t. 12, f. 13.
New Guinea.

TRIGONODERA. Gerstäcker.

955 PRUINOSA, Fairm. Ann. Ent. Belg. XXVII. 1883, (2) p. 32.
New Britain.

ZONITOIDES. Fairmaire.

956 MEGALOPS, Fairm. Ann. Ent. Belg. XXVII. 1883, (2) p. 32.
Duke of York Island.

Family ŒDEMERIDÆ.

ANANCA. Fairmaire et Germain.

957 OPACIPENNIS, Fairm. Ann. Ent. Belg. XXVII. 1883, (2) p. 32.
Duke of York Island.

NACERDES. Schmidt.

958 RUFIPES, MacL. Proc. Linn. Soc. N.S.W. (2) I. 1886, p. 157.
Fly River.

DANERCES. Westwood.

959 APICALIS, Westw. Trans. Ent. Soc. Lond. 1875, p. 231.

Dorey.

960 BIPARTITA, Westw. l.c. p. 230, t. 7, f. 3.

Dorey.

961 FRATERNA, Westw. l.c. p. 230.

Dorey.

962 FULVA, Westw. l.c. p. 231.

Dorey.

963 FULVICOLLIS, Westw. l.c. p. 230.

Dorey.

964 LATICORNIS, Westw. l.c. p. 232.

Aru.

965 LUTEICORNIS, Westw. l.c. p. 229.

Dorey.

966 NIGRA, Westw. l.c. p. 230.

Dorey.

967 PICEA, Westw. l.c. p. 230.

Dorey.

968 SUTURALIS, Westw. l.c. p. 231.

Dorey.

NOTES AND EXHIBITS.

Mr. Etheridge exhibited the fossils described in his paper.

Mr. Fletcher exhibited a collection of about sixty species of plants obtained by Mr. Froggatt in the neighbourhood of Derby, King's Sound, N. W. Australia, which Baron von Mueller had kindly determined. In this collection, which Mr. Macleay has generously presented to the Society's herbarium, was the specimen of *Pilotus Macleayi* described in Baron von Mueller's paper. Mr. Fletcher also stated that, with the plants collected at our various excursions, together with those presented by the Hon. W. Macleay, Mr. Whitelegge (fifty named species of *Hepaticæ*), and several other gentlemen, we had now the nucleus of a fair herbarium, and that he would be glad to receive specimens of the rarer plants of the County of Cumberland, as well as of plants from other localities.

Mr. Deane pointed out that a specimen of *Dodonæa polyzyga* in the collection of plants from Derby, exhibited by Mr. Fletcher, had bisexual flowers in contradistinction to the common species which are dioecious.

Mr. Maiden exhibited specimens of a fungus (*Xylostroma giganteum*, Fries,) from the wood of the spotted-gum (*Eucalyptus maculata*), but he stated that he had also seen it in the concentric circles of the wood of the Blood-wood (*E. corymbosa*). This fungus is remarkably like chamois-leather in appearance and texture, and has already been recorded by Rev. Dr. Woolls as occurring in the wood of the Red-Ironbark (*E. siderophloia*).

Mr. Maiden also showed a collection of specimens of fifty rare plants from the neighbourhood of Milparinka, collected by Mr. Baeuerlen, among which were a number not hitherto recorded from N. S. Wales. Especially worthy of note were a new *Grevillea*, *G. Kennedyana*, F.v.M., and *Hakea lorea*, R. Br. Mr. Maiden stated that the collection would be left at the Hall for a week for the inspection of members.

Mr. Whitelegge exhibited five new species of Mosses, lately described by Dr. Carl Müller in the "Ratisbon Flora" (No. 1, 1888), as follows:—*Archidium stolonaceum*, C.M. (Paddington, Nov., 1884); *Astomum viride*, C.M. (Mossman's Bay, Aug., 1884); *A. brachycaulon*, C.M. (Paddington, Aug., 1884); *Bruchia Whiteleggei*, C.M. (Moore Park, July, 1884); *B. amoena*, C.M. (near Moss Vale, Nov., 1884).

Dr. Katz exhibited under the microscope the bacillus of fowl-cholera in a quite recent section from the liver of a hen which had died of this disease (in Germany). He pointed out some peculiar features in the life-history of this interesting micro-organism, and said that it must be entirely left to experiment to decide whether it will prove of any service in the eradication of rabbits in Australia. He regretted that for the present it was not possible for him to show Members the living organism; since, unfortunately, a tube containing a pure culture of it, sent to him from Germany about a year ago, contained on arrival no living individuals. It was not improbable that the disease (also called poultry-typhoid) existed already in Australia. He also showed diagrams of the above bacillus.

Mr. S. C. Burnell exhibited a living specimen of *Pygopus lepidopodus* 25 inches in full length, from Wentworthville near Parramatta.

The President exhibited some fossils, probably species of *Pentameris*, *Cyathophyllum*, *Lithostroton*, and *Favosites*, from the lower beds of Limestone, Clieveden, Molongulli, county Bathurst. These lower beds are highly argillaceous and shaly, and much altered by pressure, heat and other metamorphic agencies. There is some reason to regard them as the same (or contemporaneous) with the auriferous shales which occur at the junction of the Belubula River and Mandurama Creek, which were formerly worked as the Junction Reefs.

Also a fragment of limestone with Pleistocene Bone Breccia attached, from a cave in Clieveden.

Also, for Mr. Norton, an internal cast, in sandstone, of a new Crinoid, probably from the carboniferous formation in the neighbourhood of the Shoalhaven. Mr. Etheridge stated that a single specimen of the same fossil, otherwise unique, has been obtained by Mr. Barnes while collecting for the Australian Museum, in the locality indicated.

Mr. Douglas-Ogilby exhibited a snake from the South Solitary Island, which he had shown previously to Mr. Macleay, with whom he agrees that it is the representative of a new genus. It is closely allied to *Pseudechis*, but differs from it in having a single nasal shield, a point which seems to be considered of great importance.

Mr. North exhibited skins of *Alcyone pulchra*, Gould, together with the nest and eggs described in his paper.

The President read the following notes, and exhibited specimens of the Plants therein referred to, on behalf of Dr. Woolls:—

I. *Jussiaea repens* (Linn.)

Baron Mueller has recently been engaged in investigating the Australian species of *Jussiaea*, and has come to the conclusion that our *J. repens* (Linn.), is not identical with the Indian species. He inclines rather to refer it to *J. diffusa* (Forskael), and as such he proposes to call it in his forthcoming "Key to the Dichotomous System." In our plant (at all events that growing near Sydney or the Hawkesbury), the petals of the flowers are yellow and entire, whilst the roots seem to be destitute of the natatory organs which mark the Indian plant. In Mr. Bentham's description, it is described as creeping in mud or floating in water, "*often sustaining itself by the vesicles round the insertion of the leaves*;" but it demands further investigation to ascertain whether this refers to the Australian or the Indian plant. In order to settle the matter, the Baron is sending specimens of our plant to Dr. Schwainfurth, now engaged in scientific pursuits at Cairo, to be compared with the plant growing in the Nile, which was collected there in 1763, and thus to determine whether our *Jussiaea repens* is to be

referred to the African *J. diffusa*, or the Indian plant. It is just possible that, as our plant extends from the north-eastern coast to Victoria and South Australia, it may vary in the colour of the petals and the development of the natatory organs, so that whilst the northern specimens resemble those of India, the southern ones may approach nearer the African form. Members of the Linnean Society residing in different parts of Australia, would do service by collecting specimens of this *Jussiaea*, and forwarding them to the Council of the Linnean Society for comparison.

II. ON SOME PLANTS FROM THE LACHLAN.

(1) *Hibiscus Sturtii* (Hook.). This plant which was first noticed by the late Sir Thomas Mitchell (see Trop. Aust. p. 363), is remarkable for its monophyllous involucre, almost wholly concealing the calyx. The flowers are described as purple, but they are probably pink when fresh. Mr. Benthams, who had before him specimens from different parts of Australia, says the species is very variable, but that it may always be known by its cup-shaped involucre.

(2) *Glycyrrhiza psoraleoides* (Benth.) was collected by Mitchell and Sturt, and Baron Mueller has figured it in his "Lithograms of Victorian Plants." The genus was named originally from the sweetness of its roots, but the Liquorice of commerce is now known as *Liquoritia officinalis*.

(3) *Helichrysum semipapposum* (DC.). There are many varieties of this plant in the Australian colonies, and Mr. Benthams was inclined to include them all under *H. apiculatum*. The specimen from the Lachlan seems to be distinct, and differs very much in habit from any varieties near Sydney, though agreeing in pappus.

(4) *Isoetopsis graminifolia* (Turcz.) is a very curious little composite. It is the solitary species of a genus endemic in Australia, and common to four of the colonies.

(5) *Justicia procumbens* (Linn.) in its small and erect variety is common to Asia and Africa, as well as Australia.

WEDNESDAY, 28TH MARCH, 1888.

The President, Professor Stephens, M.A., F.G.S., in the Chair.

MEMBERS ELECTED.

Miss Fanny Hunt, B.Sc., was elected an Associate Member ; Mr. C. W. Musson of Narrabri, and Mr. Sydney Cox of Sydney were elected Ordinary Members.

The President made the following announcements :—

- (1) That the Council had elected the Rev. T. Blackburn, B.A., of Adelaide, a Corresponding Member of the Society.
- (2) That the monthly issue of post cards, giving notice of the Ordinary Meetings, has been suspended for the present ; that, instead, cards giving the fixtures for the rest of the year will be sent out, and that each Abstract will contain a note in reference to the date of holding the succeeding meeting.
- (3) That the next Excursion would take place on April 21st, Members to meet at Circular Quay at 10 a.m., for a harbour cruise. A steamer and refreshments will be provided. In order to facilitate arrangements, Members intending to be present are requested to notify the same to Mr. Fletcher by the preceding Thursday.

DONATIONS.

"International Fisheries Exhibition, London, 1883.—The Fisheries Exhibition Literature." (14 Vols.); "Donovan's Exotic Insects." Vol. I. (Insects of China), II. (Insects of India and the Indian Seas), III. (Insects of New Holland, New Zealand, New Guinea, &c., &c.); "The Microscopic Journal and Structural Record for 1841 and 1842;" "The Transactions of the Microscopical Society of London." Vols. I.-III. (1844-52); "Quarterly Journal of Microscopical Science." 1st Series (8 Vols.), (1853-60); 2nd Series, Vols. I.-XXI. (1861-81); "The Philosophical Transactions of the Royal Society of London," from 1665-1800 (Abridged), 18 Vols. 4to.; "Zeitschrift für wissenschaftliche Zoologie," XLVI. Band, Heft 1 (1887); "Notes from the Leyden Museum." Vol. IX., No. 4 (1887). "Archives de Biologie." Tome VI., Fasc. 4, and T. VII., Fasc. 1 (1887). *From the Hon. W. Macleay, F.L.S., &c.*

"The Journal of the Bombay Natural History Society." Vol. II., No. 4 (1887). *From the Society.*

"Bulletin de la Société Belge de Microscopie." XIV. Année, Nos. 2 et 3 (1887). *From the Society.*

"Abstracts of Proceedings of the Zoological Society of London, 17th Jan., and 7th Feb., 1888." *From the Society.*

"Bulletin de la Société Impériale des Naturalistes de Moscou." Année 1887. No. 4; Supplément (Meteorological). *From the Society.*

"Zoologischer Anzeiger." XI. Jahrg., Nos. 270 and 271 (1888). *From the Editor.*

"The Forest Flora of South Australia." Part 8. By J. E. Brown, F.L.S., Conservator of Forests for the Government of S.A. *From the Government Printer, Adelaide.*

"The American Naturalist." Vol. XXI., No. 12 (December, 1887); XXII., No. 253 (Jan., 1888). *From the Editors.*

"Bulletin of the American Geographical Society." Vol. XIX., No. 4 (1887). *From the Society.*

"The Canadian Record of Science." Vol. III., No. 1 (1888). *From the Natural History Society of Montreal.*

"Geological and Natural History Survey of Canada.—Catalogue of Canadian Plants. Part iii.—Apetalæ." By John Macoun, M.A., F.L.S., F.R.S.C. *From the Director.*

"Journal and Proceedings of the Royal Society of New South Wales." Vol. XXI., Part 3 (1887). *From the Society.*

"Comptes Rendus des Séances de l'Académie des Sciences, Paris." Tome CV., Nos. 24-26 (1887). *From the Academy.*

"Revue Coloniale Internationale." Tome V., No. 6 (December, 1887). *De la part de l'Association Coloniale Néerlandaise à Amsterdam.*

"The Victorian Naturalist." Vol. IV., No. 11 (March, 1888). *From the Field Naturalists' Club of Victoria.*

"Feuille des Jeunes Naturalistes." No. 208 (Feb., 1888). *From the Editor.*

"Mémoires de la Société des Naturalistes de Kiew." Tom. VIII., Livs. 1 et 2 (1886-7); "Supplément au Tome VIII." *From the Society.*

"Scientific News for General Readers." New Series. Vol. I., Nos. 1 and 2 (1888). *From the Editor.*

"Monatliche Mittheilungen des naturwissenschaftl. Vereins des Reg.-Bez. Frankfurt." Jahrg. V., Nos. 7 and 8 (1887). *From the Society.*

"Australian Journal of Pharmacy." Vol. III., No. 27 (March, 1888). *From the Editor.*

"Horæ Societatis Entomologicæ Rossicæ." Tom. XXI. (1887). *From the Society.*

"Mémoires de la Société Royale des Sciences de Liège." Deuxième Série, Tome XIV. *From the Society.*

"Journal of the Royal Microscopical Society, 1888." Part I. (February). *From the Society.*

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NOTES ON THE *HEMIPTERA* OF THE HAWAIIAN
ISLANDS.

BY REV. T. BLACKBURN, B.A.

(Communicated by Hon. W. Macleay, F.L.S.)

In my collection of *Hemiptera* from the Hawaiian Islands there are a few species that it seems desirable to describe of which I have only a single specimen in sufficiently good condition to be treated as the type of a species, and a few which occurred to me only immediately before my departure from the islands, when I had not time to examine them. I propose now to furnish descriptions of some of these, together with remarks on certain other species that it is not practicable for me to name on the existing material, and some general observations.

SCUTATINA.

In this family *Echalia* is the predominant form. It is extremely abundant on various trees (especially *Aleurites*) at almost all elevations exceeding 1000 feet above the sea. I see Dr. White (Ann. and Mag. of Nat. Hist., May, 1878) considers that I have sent him two species (*patruelis*, Stål, *pacifica*, Stål). I do not feel very fully satisfied myself on this point. It is difficult to obtain two precisely similar specimens of the genus; and though I was at first disposed to believe the species numerous, I ended by being unable to divide them at all. However, I bow to superior authority. I have a single specimen from the north-east of Hawaii—a very much narrower and more parallel insect than the common one—which seems distinct; but it is mutilated and unfit for description, and, moreover, may be *Æ. grisea*, Burm., (of which I have not seen the description).

Of *Coleotichus* I have a mutilated specimen taken from a spider's web on Konahuanui, Oahu, at an elevation of some 2000 feet, which appears to be distinct from *C. Blackburniae*, White. It is more elongate, with the surface of the thorax uneven, but is not fit to describe fully.

Between *Geotomus subtristis*, White, and *G. jucundus*, White, I can find only colour differences. The two occur in company, and form, in my opinion, only one species.

LYGÆINA.

I have three specimens, not in first-class condition, of what I believe to be *Dysdercus Peruvianus*. They were obtained singly by sweeping ferns at a considerable elevation on the Waianae Mountains, Oahu, and Haleakala, Maui.

NYSIUS.

N. longicollis, sp.nov. Angustus, nec nitidus, pallide griseo-testaceus; antennarum articulo primo, et pedibus, nigro maculatis; antennarum articuli secundi apice et articulis 3-4 totis, capitis lateribus, vitta transversali post thoracis marginem anteriorem, scutelli parte mediâ, et corii margine apicali (partim) vittisque duabus discoidalibus, nigrescentibus; membranâ nigro-umbratâ. Subtus griseo-niger; antennis sat brevibus; capite pronoto scutelloque densius nec fortiter punctulatis; pronoto antice sat fortiter angustato, longitudine latitudini æquali. Long. $4\frac{1}{2}$ mm.

Allied to my *Nysius* no. 72 (in the hands of Dr. White), as regards the shape of the pronotum. There is a broad transverse band (which is somewhat enlarged backwards about its centre) of a blackish colour. The middle part of the apical margin of the corium is broadly blackish, and two broad blackish fasciæ proceed from this blackish margin along the disc to a little past the middle of the corium. The nervures are of a pale brown colour. The beak is shorter than in *Nysius* no. 72, the distance of its apex from the front margin of the eyes being not greater than that from the front margin of the eyes to the back of the head.

My specimen is a male ; it occurred on Oahu, but the particulars of its capture have been lost.

N. Mauiensis, sp.nov. Oblongus, nitidus, glaber, testaceo-eburneus, nigro et fusco maculatus ; antennis brevibus, articulo ultimo incrassato ; capite obscure punctulato nec ruguloso ; pronoto transverso parce fortiter punctulato, margine antico quam margo posticus $\frac{1}{4}$ brevior ; scutello fortiter 3-radiatim carinato ; corii clavique venis marginibus et maculis nonnullis magnis confusis fusconigris ; membranâ conspicue fusco-umbratâ ; corii marginis costalis parte quartâ basali rectâ. Long. 5 mm.

This insect is allied to *N. arboricola*, White, from which it differs as follows. The antennæ are evidently shorter with the apical joint more thickened ; and they are much more conspicuously variegated in colour, each joint (except the last) having several strongly contrasted rings of colour,—black, testaceous, or ivory white. The head is black, and very smooth as compared with that of *arboricola*, a conspicuous line of ivory yellow runs down the beak, and another surrounds each eye. The thorax is so mottled with colour as to be difficult to describe, but it does not much differ from that of *arboricola*, except in having the limits of its colours more sharply defined and the punctuation even more irregular than in that species, for it consists of about five distinct wavy lines of punctures somewhat interrupted here and there, among which there are many shining glabrous spaces. The corium is considerably more strongly and extensively clouded with fuscous than in *arboricola*, and the membrane bears a single very conspicuous and broad dark fuscous stain which runs from the base to the apex. [I may observe here that in some of my specimens of *arboricola* the membrane is marked with five or six obscure pale fuscous clouds of which none are entire and some are much shortened,—a character not mentioned in Dr. White's description]. The elytra have the peculiar shape noticed in those of *N. Blackburni*, White. The femora are very distinctly black-spotted, and the tibiæ and tarsi are conspicuously ringed with dark fuscous.

My single specimen (taken on Haleakala, Maui, at an elevation of about 4500 feet) is a male, and I do not notice that it differs in any conspicuous way on the underside from the same sex of *N. arboricola*, White.

N. Whitei, sp. nov. Oblongus, nitidus, glaber, rufo-testaceus fusco-maculatus; antennis mediocribus; capite vix punctulato, obscure transversim rugato; pronoto transverso parce fortiter punctulato, antice angustato; scutello fortiter 3-radiatim carinato; corii et clavi venis rufo-brunneis, hujus margine apicali infuscato, illius trimaculato; membranâ juxta mediam basin infuscatâ; femoribus posticis conspicue fusco cingulatis; corpus subtus nigrum rufo-notatum.

Long. $3\frac{3}{4}$ mm.

This insect is another ally of *N. arboricola*, White, though it is very differently coloured. The legs and antennæ are uniformly reddish-yellow, except the hind femora, which have a broad conspicuous dark fuscous ring near the apex. The rest of the upper surface is of a yellowish-brown colour, somewhat varying in shade and with the following dark fuscous markings, viz., an obscure longitudinal line on each side of the beak, a spot at each posterior angle (and another at the middle of the base) of the thorax, the apical margin of the clavus, three spots along the apical margin of the corium, a spot near the middle of the basal margin of the membrane, and a scarcely traceable cloud extending from near the base of the membrane to the apex. The head is almost absolutely glabrous. The underside is black,—the margins (broadly), and some marks near the hind margins of the apical segments, being red. The apical segments of the hind body are not notably emarginate behind.

Differs from *N. Mauiensis*, *inter alia* by its much longer antennæ of which the apical joint is but little incrassated.

A single ♀ example was obtained by beating flowers at an elevation of about 4000 feet on Mauna Loa, in the month of February.

METRARGA.

M. contracta, sp. nov. Sat elongata, fusco-brunnea, testaceo-marmorata; antennis, pedibusque elongatis; capite sat crebre punctulato; pronoto transverso fortius interrupte punctulato, angulis anticis rotundatis; scutello punctulato; corii marginis costalis parte basali rectâ. Long. 9 mm.

This fine insect rather closely resembles *M. nuda*, White, in general appearance. The markings are very similar, save that the corium and membrane have a somewhat less mottled appearance; the legs, antennæ, and rostrum are all longer; the puncturation is somewhat finer throughout; and the thorax is without the anterior spines, and is evidently shorter. The most striking character, however, is the straightness of the basal part of the costal margin of the corium, the arched dilatation commencing at a distance from the base equal to about a fifth of the length of the whole costal margin. This gives the insect, when the elytra are in repose, a peculiar contracted appearance in the middle.

I do not observe any remarkable character on the underside of my specimen—which is a female—but I observe that in the female of *M. nuda*, White, (which sex I was unable to send to Dr. White), the penultimate ventral segment is rather strongly emarginate (in a rounded manner) behind.

This species occurred among decayed leaves, &c., on Kona-huanui, Oahu, at an elevation of about 2500 feet.

M. obscura, sp. nov. Ovals, sordide fusco-brunnea testaceo-marmorata; antennis, pedibusque mediocribus; capite prothoraceque confertim nec fortiter punctulatis; hoc antice utrinque acute spinoso; scutello profunde punctulato; corii margine costali regulariter arcuato. Feminae abdominis segmento penultimo postice vix emarginato. Long. 8 mm.

This species is closely allied to *M. nuda*, White, but appears to be really distinct by the following characters:—the colour is more obscure, the puncturation finer and closer, the apical joint

of the antennæ entirely of a more or less dark fuscous colour, and the penultimate segment of the hind body is much less emarginate behind in the female.

A few specimens occurred among vegetable refuse on Mauna Loa, Hawaii, at an elevation of about 4000 feet above the sea.

N.B.—I possess a single specimen of *Metrarga* from Kauai which appears to me to be so close to *M. nuda*, White, that I hesitate to treat it as distinct. At the same time I feel little doubt (on the sexual characters alone) that it *is* distinct, for my specimen (which is a ♀) has the penultimate ventral segment scarcely emarginate.

CAPSINA.

The *Capsina* are, comparatively speaking, rather plentiful in the Hawaiian Islands. I possess upwards of forty species, of which I have not been able to send much more than a dozen to Dr. White. Unfortunately these are among the frailest of insects, and a great many of my species are represented by single types, some of them in inferior condition. From collecting expeditions I was usually obliged to bring home most of my captures unmounted, in sawdust, and the *Capsina* often suffered. The obscurity and difficulty of this group are so great that I think an entomologist who has not made them a special object of study would be more likely to hinder than assist future workers if he attempted to deal with them in print, and I act on this opinion by passing on without further remark to the

ANTHOCORINA.

This group is not richly represented, as far as I have observed, in the Hawaiian Archipelago. *Acanthia lectularia*, Linn., is distressingly abundant, and the species of *Cardiastethis* are not uncommon. (I have a single specimen of an insect allied to *C. sodalis*, White, which is probably new, but I shall not venture to describe it). The single species of *Lilia* and the two of *Dilasia* are not infrequently met with in beating branches of trees on the

higher mountains, - though I do not actually possess a great number of specimens. I have also a single specimen of a pretty little species of *Anthocorina* taken on Oahu which does not seem to fit into any described genus known to me, but I think the safer plan is to let it alone for the present.

EMESIDÆ.

PLIARIODES.

P. rubromaculata, sp. nov. Grisea, fusco maculata; antennis, pedibus hemelytrisque dilutioribus, his griseo (ante apicem rubro) maculatis, illis fusco-nigro annulatis; pronoto inæquali postice obscure bituberculato. ♀ Long. $5\frac{1}{2}$ mm.

Of a rather uniform grey colour, the antennæ and legs paler marked with conspicuous blackish rings. The hemelytra are whitish, thickly mottled over their whole surface with small grey blotches, giving them the appearance of being grey with a network of white veins. Near the apex of the costal margin of the membrane is a very small and very bright red spot. The hind wings are dull transparent grey in colour. The surface of the thorax is uneven having several obscure longitudinal ridges, the two most noticeable of which each terminate posteriorly in an indistinct tubercle; these tubercles are very much smaller and less conspicuous than those in *P. Whitei*, mihi.

A single specimen of this very distinct little insect was beaten from a species of *Ohia* at an elevation of about 4000 feet on Mauna Loa, Hawaii.

I have a mutilated ♂ specimen of this insect, or a close ally, taken on one of the mountains near Honolulu. Beyond the pilosity of the antennæ (doubtless a sexual character), I cannot find any but slight colour distinctions from the Hawaiian specimen, viz., that the red spot on the hemelytra is larger and paler, and that some of the costal markings are of a darker colour.

P. pulchra, sp.nov. Fusca, griseo et rufo-brunneo maculata; antennis fusco annulatis; pedibus albidis nigro annulatis; hemelytris albidis fusco maculatis; capitis et prothoracis parte posteriori, et scutello toto, læte rufo-brunneis; pronoto canaliculato, postice elevato vix tuberculato. ♀ Long. $5\frac{1}{2}$ mm.

This is an extremely pretty species but very difficult to describe owing to the diversity of its colours. The underside is of a rather fuscous colour with the margins of the abdominal segments paler. The head is of an obscure fuscous colour shading off behind into bright red-brown; the front half of the thorax is quite blackish, the hinder half bright red-brown; the antennæ are whitish-fuscous with obscure fuscous rings; the legs are almost white with rings nearly black in colour. The basal half of the hemelytra is pale fuscous mottled with darker shades of the same colour; the apical half of a clear snowy white tint, mottled with fuscous in such manner that there is a strongly angulated transverse broad white fascia about the middle of the hemelytron, followed by a mottled space about double as broad; beyond this is another transverse white fascia which is broad on the two opposite margins and irregularly contracted (almost to disappearance) in the middle; and again beyond this fascia the apex of the hemelytron is much mottled with fuscous. The thorax is peculiarly shaped, the plane of its upper surface being inclined backward and upward from the horizontal; a corresponding (but reversed) formation of the scutellum compensates for this peculiarity of the thorax, and brings the base of the hind body into about the same plane as the head. The thorax has a distinct longitudinal channel. Its hind margin is peculiar and difficult to describe; it is not tuberculated but appears to be strongly trisinate, the external portions of this sinuation in some aspects looking like small tubercles. This sinuation is of the extreme hind margin,—almost on the hinder face above the scutellum,—so that when looked at from the level of the head and in front it is hidden, and the thorax appears truncate behind.

A single specimen was taken by beating branches of trees in one of the numerous ravines on Konahuanui, Oahu, at an elevation of about 2000 feet above the sea.

N.B.—I may add that I have mutilated (possibly immature) specimens, apparently of two distinct species of this group, both taken among damp decaying leaves near a waterfall on Oahu. The length of leg and antenna in these is most extraordinary. With a trunk not much above $\frac{1}{4}$ in. in length, the span from the apex of the hind leg to the apex of the antennæ (supposing them extended backwards and forwards respectively) would be little less than two inches.

NABINA.

NABIS.

N. rubritinctus, sp. nov. Elongatus, rufo-testaceus fusco rufo et nigro variegatus; antennarum articulo primo crasso; femoribus anticis capite prothoraceque conjunctis haud longioribus; prothorace postice quam longiori haud latiori, lateribus nullâ parte parallelis; hemelytris alisque abdominis apicem superantibus. ♂ Long. $8\frac{1}{2}$ mm.

This species is rather closely allied to *N. subrufus*, Wh., but easily distinguished by the structural character mentioned above. The general colour of the upper surface is a rather bright testaceous yellow, which is tolerably uniform save as follows:—the antennæ are slightly infusate near the apex; the femora are rather thickly, but not conspicuously, dusted with minute black spots; the tarsi are blackish at the apex; the collar and the middle part of the basal lobe of the thorax have a greenish tinge; the anterior lobe of the thorax has some linear blackish markings (probably variable) among which are two semicircles on the base; the scutellum has a very broad rather bright red margin, within which it is black; the nervures of the corium and clavus are obscurely reddish becoming near the apex (and along the apical margin) of the corium a vivid carmine. The portion of the corium which in repose is hidden under the pronotum is nearly black. The membrane is infusate but not spotted. The hind wings are of a smoky black colour. The upper surface of the hind body is quite black, save

the margins and apex, which are yellow. Of the under side the central portion of the breast is black, the remainder clear yellow.

A single male of this handsome insect occurred on Maui, but I regret to find that I have no record of the exact circumstances of its capture.

N. oscillans, sp.nov. Elongatus, obscure rufus, fusco et testaceo variegatus; antennarum articulo primo gracili; femoribus anticis capite prothoraceque conjunctis longioribus; prothorace postice quam longiori vix latiori, lateribus nullâ parte parallelis; hemelytris alisque abdominis apicem superantibus. ♂ Long. 8 mm.

This insect is somewhat closely allied to *N. subrufus*, White, but is differently coloured and has both the lobes of the prothorax considerably and regularly contracted towards the front. The colour is an obscure reddish-brown; the antennæ are pale testaceous with no other markings than an obscure infuscation of the apex of the first and second joints. The legs are testaceous, obscurely and finely dusted with fuscous, the apex of the femora being obscurely infuscate. The apex of the costa of the corium is only slightly infuscate. On the underside only the central part of the sternum is infuscate, its sides being red with blackish sutures. The upper surface of the hind body is infuscate, and the membrane is paler than in *N. subrufus* and less variegated. In other respects it resembles it.

A specimen occurred on Mauna Loa, Hawaii, at an elevation of about 4000 feet above the sea: a second specimen taken near the same spot, and somewhat smaller, is probably conspecific.

N. innotatus, White. This appears to be a widely distributed species. From widely separated localities on Oahu, from Maui, and from Hawaii I have specimens apparently identical, save that in some of them the few markings are darker and better defined than in others. In most of them there are a few fuscous spots near the apex of the corium which do not appear to exist in the specimen I sent to Dr. White, and on which his description was founded.

N. Koelensis, sp.nov. Elongatus, fuscus, nigro et rufo variegatus; antennarum articulo primo capite sublongiori; femoribus

anticis capite prothoraceque conjunctis vix longioribus; prothoracis margine postico fortiter bisinuato. ♀ Long. 8 mm.

Structurally this insect does not appear to differ much from *N. subrufus*, White, except as follows:—the anterior femora are proportionately shorter, and the thorax is strongly bisinuate behind. The colour and markings, however, are quite different. Of a rather pale fuscous colour, it has numerous confused linear markings on the head and anterior lobe of the prothorax, some cloudy spots on the collar and posterior lobe of the prothorax, a number of conspicuous spots on the corium and clavus, the nervures of the membrane and hind wings, the apex of the second joint of the antennæ, the apex of the femora, and some fine spots on the legs, all deep blackish fuscous. The scutellum is black edged with red. The underside is clear testaceous yellow, with the centre of the breast, the lateral margins of the hind body, and a line down the centre of the apical segments of the hind body black. The upper surface of the hind body is of a deep shining black colour, with the lateral margins narrowly testaceous.

A single specimen occurred on Lanai near a place called Koele.

N. (?) curtipennis, sp.nov. Apterous; oblongo-ovatus; pallide testaceus fusco vel nigro variegatus; abdomine supra (segmentis apicalibus fuscis exceptis) rufo, infra fusco rufo et testaceo variegato; hemelytris abdominis apicem haud attingentibus.

[Long. $7\frac{1}{2}$ mm.

Allied to *N. (?) lusciosus*, White. The thorax is thickly blotched with blackish colouring, and the legs are conspicuously annulated with the same colour. The hemelytra do not quite reach the apex of the hind body.

A single specimen occurred near Waimea, Hawaii.

SALDINA.

SALDA.

S. Oahuensis, sp.nov. Opaca; brevis; lata; nigra, testaceo variegata; capite pronoti apice latiori; pronoti lateribus postice rotundatis; antennarum articulo ultimo incrassato, tertio brevior.

[Long. $3\frac{3}{4}$ mm., lat. $2\frac{1}{2}$ mm.

This small species is very distinct from any other taken by me. The beak is obscurely testaceous; the head, thorax, and scutellum are black without markings, and are very little shining owing to their surface being minutely wrinkled. The thorax is strongly narrowed anteriorly with a very conspicuous rounded fovea on the disc; the sides of its hinder half are quite evidently rounded; those of the anterior half straight. The clavus is almost wholly black (there is a small obscure pale mark near the apex). The corium is so variegated as to be very difficult to describe: the prevailing colour is a pale testaceous brown, with the nervures dark fuscous. Along the costal area the fuscous markings are— a small spot near the base, a linear kind of mark before the middle, a large conspicuous blotch just beyond the middle, and another nearly as large near the apex. The rest of the corium is somewhat blotched with deep brown-black (more in one of my specimens than in the other), and the pale testaceous colour becomes, in places, abruptly almost white. The antennæ are of an obscure colour, paler at the base, and their apical joint is thickened and shorter than the penultimate. The legs are testaceous, their femora, tibiæ, and tarsi all being marked with a darker colour. The underside is of an obscure blackish colour. The peculiar lateral outline of the thorax at once distinguishes this species from its known Hawaiian congeners.

Two specimens occurred near a waterfall several miles from Honolulu.

SOME REPUTED MEDICINAL PLANTS OF NEW
SOUTH WALES.

(INDIGENOUS SPECIES ONLY.)

BY J. H. MAIDEN, F.L.S., &c.

(1) Botanical diagnoses have been rigidly excluded, as they can readily be obtained from the *Flora Australiensis* at the places indicated.

(2) References are given to the *Flora Australiensis*, but note is made of all differences of synonymy between that work and the "*Census of Australian Plants*" by Baron von Mueller.

(3) The alphabetical order of species-names has been given, in the belief that that arrangement will be the most generally convenient in a paper of this kind.

(4) Detailed references to the gums, resins, and kinos, also to the essential oils (although medicinal), have been omitted, as these substances form groups which can be conveniently dealt with by themselves.

(5) Some of the plants referred to are better known as "Foods," "Timbers," "Tans," &c., but I have endeavoured to keep strictly to the subject of my paper.

(6) I have given the names of authors of statements wherever I could ascertain them.

(7) This paper may be looked upon as a companion-paper to that of Mr. Bailey on "The Medicinal Plants of Queensland" in the Proceedings of this Society, Vol. V., p. 1.

Since this was written I have observed a short paper by the Rev. Dr. Woolls, entitled "Plants of New South Wales having Medicinal Properties," in the *Victorian Naturalist*, p. 103, Vol. IV.

In regard to the "New Remedies," it will be well to remember the judicious remarks of Sir Joseph Hooker in his introductory essay on the Flora of Australia, appended to the "Flora of Tasmania."

"I have not alluded to pharmaceutical plants: such may exist, and multitudes of the weeds, seeds, and roots of Australia will no doubt enjoy a more or less substantial reputation as drugs, for a period, and then be consigned to oblivion. This is the pharmaceutical history of the plants of all countries that have long been inhabited by civilized man, and Australia will form no exception to them, the fact being, that of the multitude of names of plants that appear in Pharmacopœias, the number of really active and useful plants is extremely small."

Queensland is by far the richest of the colonies in plants concerning which medicinal properties have been recorded; but the great majority of these will be found to be also common to India and the Archipelago, and to have been used by the natives of those countries.

With the exception of some plants not endemic in Australia, which have already been utilized by dwellers in older countries, most of the plants of this continent reputed medicinal, have been inquired into only when their true botanical positions were assigned. We are aware that certain properties are possessed by plants belonging to certain genera and natural orders; when an Australian plant is found to belong to such an order or genus, we can usually make a very sagacious surmise as to its properties. The science of botany, therefore, may save the student of *Materia Medica* from groping about, and testing plants in an empirical way. Nevertheless, there is still much empiricism in the study of vegetable *Materia Medica*, as it is only of comparatively recent years that the analyst and physician have recognised the enormous mutual advantage of co-operation with the botanist. Yet comparatively few genera have been tested for medicinal properties throughout the world, so that the limit of the aid afforded us by analogy is easily passed.

Australian botany may be said to have been brought into order by the publication of the *Flora Australiensis*, the oldest volumes of which only date back some twenty-five years. Before that time very few people in these colonies professed any botanical knowledge whatsoever, and our plant-nomenclature was in a pitiable state, empirics adding to the prevalent lack of knowledge by bestowing names on plants without a word of description, increasing the difficulty of the situation by synonymy worse than useless. Anyone need only examine old exhibition literature to be convinced of the truth of my remarks. To Baron Mueller and Mr. Bentham are of course mainly owing the "exact" position which Australian botany holds in this centenary year. The main work of the classification of our plants has already been performed, and the student of *Materia Medica* now can reap the advantage. There is no doubt that many observations of early colonists on the medicinal properties of plants have been lost to us through their lack of botanical knowledge, or lack of facilities to have plants named in which they were interested. And considering the circumstances under which many of the pioneers of this colony worked, it becomes a matter of surprise to us, not that they have recorded so little, but that they have been recorded so much, and in such detail, in regard to the economic properties of our indigenous flora. Of course drugs form but one group or division of substances which have been pressed into the service of man.

In fairness to ourselves we must confess ourselves very little indebted to the Australian aboriginal for information as to the medical (or in fact any other) properties of our plants. The poor aboriginal chiefly takes interest in the vegetation as supplying him with his scanty food, or as affording him fibre useful in securing fish and other animal sustenance. As far as we know, the *Materia Medica* of the blacks is of a very meagre description, yet the acquisition of even such little knowledge as they are supposed to possess, has been slow and difficult, inasmuch as persons who have lived in a state of nature with them have not been distinguished for either their medical or botanical knowledge. Civilised or semi-civilised blacks frequently know but little about

their native *Materia Medica*, and the difficulty of obtaining reliable information is enhanced (as I have experienced to a slight extent) through the extreme willingness of town blacks to impart information in regard to any plant which may be shown to them, which impresses one with the thought that they are too willing to oblige. But perhaps this is mainly owing to asking them leading questions.

With the native *Materia Medica* of India, for instance, the case is very different. While some remedies are evidently used fancifully, and others for every disease to which the human frame is liable, much of the knowledge in regard to it is exact, the outcome of intelligent observation and enquiry, and the work of the European practitioner to classify the native drugs is a comparatively easy one.

There is an important matter which I have often heard referred to by medical men and others. It may be only an ingenious surmise, but I am inclined to think it is more than that, as evidence to prove its truth is from time to time brought forward. It is this. Native Australian drugs will probably be found peculiarly efficacious in the treatment of diseases, or modifications of diseases, which are co-extensive with their distribution.

The number of really useful New South Wales drugs, as far as our knowledge at present extends, is, as will be seen, but very limited, and in regard to these even, our knowledge lacks precision. It will thus be seen how little trodden has been this particular field of enquiry.

Yet it is not too early even now to attempt to systematise such knowledge as we possess,—this has been the object in view in submitting this humble contribution.

1. ACACIA spp. “Wattles.”

The barks of all wattles are more or less astringent, and are used in domestic medicine to make decoctions or infusions which are employed in diarrhœa or dysentery, perspiring feet, some

affections of the eyes, and a number of severe and trifling ailments in which an astringent may or may not be of service. Speaking generally, the wattle-barks of the dry country are ragged-looking and poor in tannic acid, while those east of the Dividing Range are more compact and far more astringent.

The astringent principle (accompanied by no injurious substance in large quantity) is present to a more or less useful extent in the barks of scores of genera of our native trees, e.g., *Eucalyptus*, *Banksia*, *Casuarina*.

The gums of some species of wattle are used to a limited extent in domestic medicine and surgery. Vide *Flindersia maculosa*, infra.

2. *ACACIA FALCATA*, Willd., N.O. Leguminosæ, B.Fl., ii., 361.

Variously called "Hickory," "Lignum-vitæ," and "Sally." It used to be called "Wee-tjellan" by the aboriginals of the counties of Cumberland and Camden.

This bark, which contains much tannin, was used by aboriginals near Sydney to stupefy fish, and to make embrocations for the cure of cutaneous diseases. (Macarthur).

This tree extends to Queensland.

3. *ACACIA IMPLEXA*, Benth., N.O. Leguminosæ, B.Fl., ii., 389.

The Rev. Dr. Woolls observes that the bitter bark of this tree probably possesses medicinal properties.

This tree is also found in Victoria and Queensland.

4. *ACACIA PENNINERVIS*, Sieb., N.O. Leguminosæ, B.Fl., ii., 362.

"Hickory" or "Blackwood."

The bark (and according to some, the leaves) of this tree was formerly used by the aboriginals of southern New South Wales for catching fish. They would throw the bark or leaves into a waterhole, when the fish would rise to the top and be easily caught. Neither the leaves nor bark contain strictly poisonous substances, but like other species of *Acacia*, they would be deleterious owing to their astringency.

This tree is found in all the colonies except South and Western Australia.

5. ACACIA SALICINA var. VARIANS, *Lindl.* (*A. varians*, *Benth.*),
N.O. Leguminosæ, B.Fl. ii., 367.

The "Goobang" of the natives of the western interior.

Sir Thomas Mitchell speaks of the natives using a bough of this tree to poison the fish in water-holes.

This tree is found in the interior of the sub-tropical portion of Australia.

6. ACHRAS LAURIFOLIA, *F.v.M.* (*Sideroxylon Richardi*, *F.v.M.*
in *Muell. Cens.* p. 92), N.O. Sapotaceæ, B.Fl., iv., 282.

The bark has a remarkably sweet taste, but is at the same time astringent. Dr. Bancroft suggests that lozenges made of an extract of it might prove useful in throat diseases. Following is Mr. Staiger's analysis of the bark:—

Extract (containing glycyrrhizin)	...	...	30
Tannin	...	...	12
A substance intermediate between india-rubber			
and gutta-percha	...	...	0.25
Woody fibre	...	...	50
Moisture	...	...	7.75
			<hr/>
			100.0

This tree extends to Queensland.

7. ACHRYANTHES ASPERA, *Linn.*, N.O. Amarantaceæ, B.Fl., v.
246.

I cannot find that this plant has yet entered into Australian domestic medicine, but in India it is extensively and variously used, although some of the uses may appear ludicrous to us. It is administered in cases of dropsy. The seeds are given in hydrophobia, and in cases of snake-bite, as well as in ophthalmia and cutaneous diseases. The flowering-spikes rubbed with a little sugar are made into pills and given internally to people bitten by mad dogs. The leaves taken fresh and reduced to a

pulp are considered a good remedy applied externally to the bites of scorpions. The flowering-spike has the reputation in India (Oude) of being a safeguard against scorpions, which it is believed to paralyse. (Drury).

This plant is found in all the tropical and sub-tropical regions of the Old World.

8. *ADIANTUM ÆTHIOPICUM*, *Linn.*, N.O. Filices, B.Fl., vii., 724.

Common "Maiden-hair fern."

This plant is said to possess medicinal properties, being slightly astringent and emetic, and it has been used in Europe in making "Sirop de Capillaire," a demulcent drink employed in diseases of the chest.

This fern is found throughout the colonies.

9. *ALSTONIA CONSTRICTA*, *F.v.M.*, N.O. Apocynæ, B.Fl., iv., 314.

"Fever-bark" or "Bitter-bark" tree.

The yellowish-brown, often thick and deeply fissured bark of this tree, is intensely bitter, and possesses valuable febrifugal and tonic properties. It is regularly quoted in London drug-lists. A decoction is sometimes sold in the colonies as bitters. Mr. Christy states that it is used by some English brewers of pale ale for export, as it produces neither headache nor other ill effects of hops. It tastes remarkably like cinchona bark, and seems to partake somewhat of the properties of both quinine and nuxvomica. This drug is undoubtedly worthy of careful experiments by medical men.

The bark contains, according to Palm (who examined it in 1863), a neutral resinous bitter principle* (similar to cailcedrin and tulucunin), a volatile oil smelling like camphor, an iron-greening tannin, gum, resin, fat, wax, protein substance, oxalic acid and citric acid. An analysis of the ash is also given. (Watts' Diet. 1st Suppl., 101).

*Called by him *alstonin*.

In the "Organic Constituents of Plants" translated by Baron Mueller from Dr. Wittstein's work, will be found an account of an alkaloid called *Alstonine* obtained by Mueller and Rummel from the bark. (q.v.)

The correctness of the above results has been disputed by Hesse, who expressed the opinion that the supposed alkaloid was a mixture of *chlorogenine* and *porphyrine*. (Ber. d. Deutsch. Chem. Gesells., 1878, p. 2175).

In June 1879, Oberlin and Schlagdenhauffen announced* the isolation of two alkaloids from this bark, a crystallizable and an amorphous one. They found the bark to be soluble in ether to the extent of 1.038 per cent, and to this ethereal extract their attention was confined. In *Pharm. Journ.* [3], ix. 1059, is an abstract of their paper, and an account is given not only of the method of preparing these alkaloids, but also of their physical and chemical properties. The crystalline alkaloid occurring in silky tufts of brilliant, colourless, isolated or stellate crystals, is styled *alstonine*† while an amorphous nitrogenous residue, possessing alkaloidal properties, obtained by spontaneous evaporation from the mother liquor which yielded *alstonine*, is provisionally termed *alstonicine*.

In 1881 an exhaustive research on this bark was contributed by Hesse to the *Annalen der Chemie* ccv. 360, of which a careful abstract appears in the *Pharm. Journ.* [3], xi. 775. Palm's "Alstonin" (notwithstanding the alleged absence of nitrogen), was shown by Hesse to consist essentially of an alkaloid which he had obtained from the bark and called *chlorogenine*. But as Palm's name had priority, Hesse called the alkaloid *alstonine*. But unfortunate confusion has arisen in Mueller and Rummel, and Oberlin and Schlagdenhauffen (*vide supra*) also having given so descriptive a name to substances of different composition. The abstract above referred to gives a very lucid account of the overlapping of various researches, and shows how the different results obtained by different observers may be reconciled. After this

* "Journal de Pharmacie et de Chimie."

† Probably Hesse's *porphyrine*.

necessary preliminary statement, Hesse gives a full account of the preparation and properties of the alkaloids found by him. They are :—

1. *Alstonine* (synonymous with *Chlorogenine*, and probably identical with Palm's "alstonin"). It is a brown amorphous mass, which can be rubbed to a brownish-yellow powder.
2. *Porphyryne*, a white powder, found in very small quantity.
3. *Porphyrosine*, the examination of which is not yet complete.
4. *Alstonidine*, consisting of colourless, concentrically grouped needles.

Hesse believes that this list by no means completely enumerates the alkaloids obtainable from this interesting bark.

This tree is also found in Queensland.

10. *ATHEROSPERMA MOSCHATA*, *Labill.*, N.O. Monimiaceæ,
B.Fl., v., 284.

"Victorian Sassafras."

The bark contains an agreeable bitter, of much repute as a tonic amongst sawyers. It is called "Native Sassafras" from the odour of its bark, due to an essential oil closely resembling true Sassafras in odour. Mr. Bosisto likens the smell of the inner bark to new ale, and says that a decoction from this part of the tree is a good substitute for yeast in raising bread.

It is diaphoretic and diuretic in asthma and other pulmonary affections, but it is known more especially for its sedative action on the heart, and it has been successfully used in some forms of heart-disease.

It is prepared of the strength of four ounces of the bark to twenty ounces of rectified spirit, and is given in doses of thirty to sixty drops, usually on a lump of sugar. The volatile oil of the bark alone is said to have a lowering action on the heart.

The bark has been examined by N. Zeyer, who has found in it volatile oil, fixed oil, wax, albumin, gum, sugar, starch, butyric acid, oxalic acid, an aromatic resin, iron-greening tannic acid, and

an alkaloid which he designates *atherospermine*. See Gmelin's Handbook, also Watts' Dict. See also Mueller and Rummel in Wittstein's "Organic Constituents of Plants" for a second method of preparing *atherospermine*.

This tree is also found in Tasmania and Victoria.

11. *BORONIA RHOMBOIDEA*, *Hook.*, N.O. Rutaceæ, B.Fl., i., 324.

Although this plant is but a recent addition to the flora of this colony, it has for a long time been used in the southern portion of it as a remedy for worms in horses. The leaves are chopped up and mixed with the fodder.

This species is also found in Tasmania and Victoria.

12. *BRASENIA PELTATA*, *Pursh.* (*Cabomba peltata*, *F.v.M.* in Muell. Cens., p. 1), N.O. Nympheaceæ, B.Fl., i., 60.

A "Water-lily."

The leaves are astringent, and have been employed in phthisis and dysentery, especially in North America.

This plant is also found in Victoria and Queensland.

13. *CASUARINA EQUISETIFOLIA*, *Forst.*, N.O. Casuarineæ, B.Fl., vi., 197.

"Forest Oak," "Swamp Oak," "Bull Oak."

The bark, according to Dr. Gibson, is an excellent astringent, and may be used with advantage in chronic diarrhoea and dysentery. It is not used medicinally by the natives of India. The Chinese in Bombay say that it is used as an astringent in China. (Dymock). Doubtless the barks of the numerous other Australian species possess similar properties. They contain by no means a small proportion of tannic acid.

This species extends to Northern Australia.

14. *CEDRELA TOONA*, *Roxb.* (*C. australis*, *F.v.M.* in Muell. Cens., p. 9), N.O. Meliaceæ, B.Fl., i., 387.

The well-known "Cedar" or "Red Cedar." Called "Polai" by the aboriginals of northern New South Wales.

This tree is also a native of India, and its bark has been found valuable in fevers, dysentery, &c.

It is astringent, and in India it is considered a reliable anti-periodic, and by Dr. Newton a good substitute for cinchona. (*Pharm. of India*).

The flowers are considered emmenagogue (Dymock).

This tree is also found in Queensland.

15. *CODONOCARPUS COTINIFOLIUS*, *F.v.M.*, N.O. *Phytolaccaceæ*, B.Fl., v., 148.

The "Quinine tree" or "Medicine tree" of the interior.

This bark, which is exceedingly brittle, and by no means thick, contains a peculiar bitter, and no doubt possesses medicinal properties. The taste is, however, quite distinct from Quinine.

This small tree is found in all the colonies except Tasmania and Queensland.

16. *COLOCASIA MACRORRHIZA*, *Schott*, N.O. *Aroideæ*, B.Fl., viii., 155.

I know no aboriginal or colonial name used in New South Wales for this plant, although for Queensland, where it is much better known than here, I have a list of five aboriginal names used in various parts of that colony. "Cunjevoi" is the one best known.

This plant possesses much acidity in the fresh state, and is employed by the natives of India as an external stimulant and rubefacient. The acrid principle is, however, very volatile, and by the application of heat, or simple drying, the roots become innocuous. (*Pharm. of India*).

As an antidote to the stings of plants, see *Laportea gigas*.

17. *CROTON PHEBALIOIDES*, *R.Br.*, N.O. *Euphorbiaceæ*, B.Fl., vi., 125.

A "Native Cascarilla." Called "Warrel" by the aborigines of Northern New South Wales.

The bark contains an agreeable aromatic bitter.

This plant extends to Queensland.

18. *CRYPTOCARYA AUSTRALIS*, *Benth.*, N.O. Laurineæ, B.Fl., v., 299.

"Laurel" or "Moreton Bay Laurel" and "Grey Sassafras."

The bark has a persistently bitter taste, due to the presence of an alkaloid which crystallises from its solution in stellate masses of acicular crystals. When administered to warm-blooded animals the alkaloid produced difficulty of respiration, ending in asphyxial difficulty and death. It also had a poisonous action on cold-blooded animals belonging to the reptilia. (Bancroft, in *Australian Journ. of Pharm.* 1887).

This tree is also found in Queensland.

19. *CUCUMIS TRIGONUS*, *Roxb.*, N.O. Cucurbitaceæ, B.Fl., iii., 317.

This is an aboriginal food, but I am unaware of its use in the colonies as a medicine. In India it is put to very interesting use. The fruit is very bitter, and at the feast of the Diwali, or New Year of the Hindus, is brought to market for sale. The Hindus of Bombay have a custom at this season of breaking the fruit under the foot, and then touching the tongue and forehead with it, with the idea that having tasted bitter of their own accord, they may hope for preservation from misfortune during the year. It is not eaten, but is used medicinally as a purgative.

This plant extends from this colony to Northern Australia.

20. *CYMBONOTUS LAWSONIANUS*, *Gaud.*, N.O. Compositæ, B.Fl., iii., 674).

In the southern parts of New South Wales the country people prepare a salve used for wounds, by extracting the medicinal properties of this plant by means of melted lard. Alternate layers of lard and leaves are made, the mass is allowed to cool slowly and afterwards the lard is run out and is ready for use.

Some country folk are loud in their praises of its quick healing effects. Mr. Bäuerlen tells me they copied this use of the plant from the Chinese. Although this humble plant is found in all the colonies, it does not extend to China, so the Chinese probably first used it in quite an empirical manner.

21. *DAPHNANDRA MICRANTHA*, *Benth.*, N.O. Monimiaceæ, B.Fl., v., 285.

"Light Yellow-wood," "Satin-wood."

The bark of this tree is intensely bitter, and is in much repute as a tonic amongst sawyers. (W. Hill).

Dr. Bancroft has quite recently drawn attention to the properties of this bark, which are similar to those of *D. repandula*, F.v.M. (Vide *Australian Journ. of Pharm.*, 1887, p. 104, and *Proc. R. S. N.S.W.*, 1886, p. 69).

This tree is also found in Queensland.

22. *DORYPHORA SASSAFRAS*, *Endl.*, N.O. Monimiaceæ, B.Fl., v., 283.

The well-known "Sassafras," peculiar to New South Wales.

The bark is used as a tonic medicine. It is taken in the form of an infusion.

23. *DRIMYS AROMATICA*, *F.v.M.*, N.O. Magnoliaceæ, B.Fl., i., 49.

This tree possesses aromatic properties, particularly the bark, which so closely resembles the Winter's Back of the Straits of Magellan (*D. Winteri*), that it is sometimes substituted for it.

This tree is also found in Tasmania and Victoria.

24. *DUBOISIA HOPWOODII*, *F.v.M.* (*Anthocercis* (?) *Hopwoodii*, *F.v.M.* in Muell. Cens.), N.O. Solanææ, B.Fl., iv., 480.

The now well-known "Pituri."

This is the masticatory of the aborigines of Central Australia, corresponding, in this respect, to the Coca of Peru, the Betel nut of the Eastern Archipelago, the "Taezi Kaat" (*Catha edulis*) of

Arabia, &c. The drug is in the form of leaves, more or less powdered, mixed with finely broken twigs, forming altogether a brown herb. So fine is the powder, and so irritating, that the most careful examination of a specimen is attended with sneezing. The plant is, as far as known, extremely local in distribution, and the blacks prize it so highly that they travel enormous distances to obtain it; besides, it is a most valuable commodity for tribal barter. They gather the tops and leaves during the month of August, when the plant is in blossom, and hang them up to dry. They are sometimes sweated beneath a layer of fine sand, dried, roughly powdered, and then packed in netted bags, skins, &c., for transport. I have examined perhaps a dozen packages of Pituri at different times, and they have all been made of netted work, or canvas. Every bag appeared to be precisely the same both in size, pattern and material. The material I believe to be obtained by the aborigines from gunny-bags or wool-packs; these are unpicked, woven into circular mats about six inches in diameter, and folded over the contained pituri like a jam-tart. The bag is then sewn up with fibre of the same material.* Two of these bags now in the Technological Museum were obtained, the one from Mount Margaret Station, Wilson River, South-west Queensland, to which it had been brought by the blacks from the Herbert River, the other also from the Herbert River, Lat. 23° S., Long. 139° E., near to Pituri Creek. In neither case can more precise localities of the place from which the pituri was procured be obtained, perhaps partly because the blacks do not wish the locality to be generally known, and partly because the packages have passed through so many hands.

Sometimes pituri is chewed in company, a quid being passed round from one native to another, and when they have had

*In the South Australian Museum the following pituri bags, (amongst others) may be seen :—

1. Skin of small animal, with the flesh-side outwards.
2. Bag of blue and red stripes, probably of European yarn.
3. A bag with red stripes, and stripes of the usual unbleached fibre.

sufficient, one politely plasters it behind his ear. It is also smoked, and to prepare the leaves for this purpose they are damped, mixed with potash prepared from the ashes of suitable plants, and rolled up in the shape of a cigar. This is often chewed, and the saliva swallowed.

In small quantities pituri has a powerful stimulating effect, assuaging hunger, and enabling long journeys to be made without fatigue and with but little food. It is also used by the aborigines to excite them before fighting. It is used to poison emus.

Wills' diary from Cooper's Creek (p. 283) has the following under date May 7th, 1861:—"In the evening various members of the tribe came down with lumps of nardoo and handfuls of fish, until we were positively unable to eat any more. They also gave us some stuff they call *bedgery* or *pedgery*; it has a highly intoxicating effect when chewed even in small quantities. It appears to be the dried stems and leaves of some shrub."

"The pituri consists of leaves broken into small particles and mixed with acacia leaves, small dried berries containing reniform seeds, and unexpanded flower-buds of the shape of a minute caper."

In March, 1872, Dr. Bancroft, of Brisbane, read a paper before the Queensland Philosophical Society on Pituri. He obtained specimens from a Mr. Gilmour, who had procured them from the neighbourhood of the Kulloo water-hole, eight miles beyond Eyre's Creek. He stated that the use of the pituri is confined to the men of a tribe called Mallutha, all the males of which are circumcised. The pituri caused a severe headache in Europeans who used it.

Dr. Bancroft then summarises the effects of an infusion of pituri, at some length.

Dr. George Bennett of Sydney has some notes on the drug in the *N.S.W. Medical Gazette*, iii., 8, May, 1873. This pituri was obtained from the same source as that used by Dr. Bancroft, but was in a damaged condition.

In September, 1878, Mr. A. W. Gerrard experimented with a very small quantity (30 grains) of pituri which had come into his possession. He found an alkaloid, to which he gave the provisional name of "pituria," but, on account of the smallness of material available, he was unable to describe its properties with much definiteness. (See *Pharm. Journ.* [3], ix., 251).

Loc. cit., p. 638, will be found a chatty account of pituri taken from the *Lancet*, to which it was sent by Mr. J. P. Murray, surgeon to a Central Australian Exploring Expedition.

M. A. Petit having obtained a quantity of pituri repeated and supplemented Mr. Gerrard's experiments. See a paper in the *Pharm. Journ.* [3] ix., 819. He pronounces the alkaloid contained in the substance to be nicotine, and quotes some physiological experiments by Professors Sydney Ringer and Murrell as supporting his view.

On 3rd Nov., 1880, Professor Liversidge of the Sydney University, read a paper before the Royal Society of N.S.W. on the subject. He had more material at his disposal than had previous observers; moreover, his research is probably the most exhaustive that has ever been made on the subject. The paper (*Proc. R.S. N.S.W.*, 1880, p. 123) scarcely bears abstracting. Prof. Liversidge isolated a brown, liquid, acrid alkaloid, distinct from nicotine, which he calls *piturine*.

This plant is found in the interior of all the colonies except Tasmania and Victoria. In other words, from the Darling and Barcoo Rivers to Western Australia.

25. *DUBOISIA MYOPOROIDES*, *R.Br.*, N.O. Solaneæ, B.Fl., iv., 474.

Called "Corkwood" and "Elm" by the colonists, and "Onungunabie" by the aborigines of the Clarence River. "Ngmoo" is another aboriginal name.

The first important statement as to the narcotic effect of this plant I can find, is recorded by the Rev. Dr. Woolls, from a correspondent of his.

“It has an intoxicating property. The aborigines make holes in the trunk and put some fluid in them, which when drunk on the following morning produces stupor. Branches of the shrub are thrown into pools for the purpose of intoxicating the eels, and bringing them to the surface. I have known an instance in which giddiness and nausea have arisen from remaining in a close room where branches of it have been placed.”

The smell is faint and sickly, but with nothing like the intensity of *D. Hopwoodii*.

Baron von Mueller directed the attention of Dr. Bancroft of Brisbane to the probable medicinal properties of this plant, and the latter obtained an extract from it which he found useful in ophthalmic surgery, and he brought it before the medical world.

The leaves owe their active properties to the presence in them of an alkaloid called *duboisine*, which Ladenberg pronounces identical with *hyoscyamine*, albeit there are minute differences between them. The method adopted by Mueller and Rummel to obtain the alkaloid will be found in the *Organic Constituents of Plants* (Wittstein, Mueller's translation).

For an account of the latest researches of Prof. Ladenberg on the subject, see an abstract in *Pharm. Journ.*, 25th June, 1887.

For an account of Gerrard's experiments with the alkaloid of this plant, together with some physiological experiments with it, *vide Pharm. Journ.* [3], viii., 787 *et seq.*

In practice, the sulphate of the alkaloid, which forms golden-yellow scales, is usually preferred. The dose is from $\frac{1}{120}$ to $\frac{1}{30}$ of a grain.

Dr. Dujardin-Beaumetz substitutes this alkaloid for atropine in exophthalmic goitre.

The extract is said to have been given with great benefit in cases of the night sweats of phthisis, without producing any bad effects on the appetite. It produced entire relief from pain in a severe case of vesical tenesmus from inflammation of the urethra and neck of the bladder.

The following references to the alkaloid are taken from Martindale and Westcott's *Extra Pharmacopœia*.

It dilates the pupil, dries the mouth, checks perspiration, causes headache and drowsiness, antagonises muscarine; on the eye it acts more promptly than atropine (*Lancet*, i., 1878, 304).

Eight cases of toxic symptoms, giddiness, delirium, and dryness of the mouth from use of eyedrops four grains to the ounce (*L.*, ii., 1879, 353).

As a mydriatic it is much stronger than atropine. Its use requires care; it is apt to produce giddiness, &c., and even delirium (*L.*, ii., 1879, 441).

Its action relative to atropine, physiologically, &c. (*Practitioner*, xxiii. 246).

Therapeutic and physiological effects. Differs from atropine by the persistence and greater rapidity of its action on the muscle of accommodation; is a useful calmate in maniacal delirium; as a sedative ointment 1 in 500 of vaseline applied night and day is useful in inflammation of the cornea (*Pr.*, xxv. 294).

In exophthalmic goitre, $\frac{1}{120}$ grain two or three times a day gives great relief (*B. M. J.*, i., 1883, 958).

Résumé of its physiological properties in *Lancet*, ii., 1881, 806; *British Medical Journ.*, ii., 1879, 362, ii., 1881, 529; *Trans. Med. Congress*, 1881, i., 511.

This tree is also found in Queensland.

26. *ERYTHRÆA AUSTRALIS*, *R.Br.*, N.O. Gentianæ, B.Fl., iv., 371.

“Native Centaury.”

This plant is useful as a tonic medicine, especially in diarrhœa and dysentery. The whole plant is used (not the root alone, as in the case of gentian, for it is very small in the plant), and is pleasantly bitter. It is common enough in grass-land. It appears to be increasing in popularity as a domestic remedy. The first reference to its use I can find is in Woolls' “*Flora of*

Australia," p. 7. No doubt knowledge of the natural order of this plant suggested its use.

It is found in all the colonies.

27. EUCALYPTUS spp.

It is very difficult to trace to individual species the properties ascribed to Eucalyptus and its products. Eucalyptus is a name very loosely used by many people, who forget that this large genus comprises (Baron Mueller's *Census*) no less than 134 species, (while a fresh one is occasionally discovered), and some of these have varieties so well marked as to be classed as distinct species by some authors. It should not be lost sight of that in this vast genus the properties of different species are frequently very different, so that to describe a product as simply "Eucalyptus" is but a bald description, and one likely to lead to great confusion. There is some excuse for this, however, as Eucalyptus products have only been brought under notice during the past quarter of a century; and some allowance must be made to outsiders in respect to their references to a genus so imperfectly known to Australians themselves. The leaves and flowers are usually far removed from the ground (especially the flowers), and some apparatus not usually possessed by pedestrians must be used to obtain the latter. They are therefore comparatively unfamiliar; this is doubtless partly the reason why they are not better known.

Eucalypts contain a *volatile oil*, varying in composition in some species, and of a somewhat complex nature, a bitter or *tonic principle* in an amorphous condition, and strongly hygroscopic, and a *Kino*.

The following species may perhaps be considered the chief medicinal species:—

For *volatile oil*, *E. amygdalina*, Labill.; *E. oleosa*, F.v.M.; *E. globulus*, Labill.

For *bitter principle*, *E. rostrata*, Schlecht.; *E. globulus*, Labill.
(All the above are New South Wales plants, *E. globulus* just coming into our territory.)

For Kino. (Those marked with an asterisk are found in New South Wales).

**E. rostrata*, Schlecht.

E. calophylla, R.Br.

**E. corymbosa*, Smith.

**E. maculata*, Hook.

E. tessellaris, F.v.M.

**E. siderophloia*, Benth.

**E. amygdalina*, Labill.

**E. piperita*, Smith.

It was formerly imagined by some that Eucalyptus leaves contained *quinia*, or some other of the well-known alkaloids of Cinchona barks. But the experiments of Broughton, the Government Quinologist, Ootacamund (India), entirely disprove this; for upon careful examination of the bark and leaves, this chemist states that neither *quinia*, nor any of the other alkaloids of Cinchona barks, as *quinia*, *cinchonina*, or *cinchonidia* exist in the plant in any proportion. The properties of the leaves therefore, so far as is known at present, depend entirely upon the volatile oil. (Bentley and Trimen, *Medicinal Plants*, 109).

The latter statement is scarcely correct, as they owe some of their properties to the bitter principle already referred to.

The juice of Eucalyptus leaves of various species has been used as a stimulant for the growth of the hair, much in the same way as rue is used, but although the remedy certainly can do no harm, the cases in which good is reported to have ensued are not so well authenticated as one could wish.

Mr. Baker (United States Consul at Buenos Ayres) reports that the people there bruise the leaves of *E. globulus*, and bind them to the forehead in nervous headache.

The leaves of *E. globulus* and other species possess febrifugal properties to some extent, and Mr. Bosisto has prepared a *Liquor Euc. globuli*, which is sold as a fever and ague remedy. It is said to counteract malaria without exciting the prejudicial effects of quinine on the nervous system. It is also used as a general tonic.

n the *Aust. Journ. of Pharm.* for May, 1887, occurs the statement that a miner at Kimberley, Western Australia, cured himself of scurvy by making a decoction of the leaves of a "White Gum." What species of *Eucalyptus* is alluded to I cannot guess at.

The dose of *Eucalyptus* leaves is given in Martindale and Westcott's *Extra Pharmacopœia* at 5 grains or more, in powder. When coarsely powdered they are employed for smoking in cigarettes in cardiac and aneurismal asthma.

The following references are obtained from the same source:—

History of the drug, its uses and botanical origin. Is a febrifuge; the leaves are also used as a healing application to wounds. (*Med. Times and Gaz.*; i., 1874, 540; *Pharm. Journ.*, 1874, 872, 1879, 865).

Ague, rapid cure of, by 1 to 2 drachm doses of the tincture. (*Practitioner*, xviii., 366).

In ozæna, bronchitis, with profuse foul expectoration, and uterine catarrh, tincture and infusion used both internally and externally. (*Pr.* xx. 206).

Tincture used in intermittent fever. (*Pr.* xx., 411, xxiv., 138).

Use of steam from the infusion of leaves in infectious diseases, especially diphtheria. (*Lancet*, i., 1883, 316).

A correspondent writes to the *Town and Country Journal* of Sydney strongly recommending the use of bruised gum-leaves in fowl-cholera, and other diseases of the poultry-yard. The leaves are astringent, and there is no doubt they would be useful on that account. Our knowledge of the diseases of poultry is almost nil, so the simple and readily available remedy of gum-leaves is worth trying.

"In France, five different *Eucalyptus* preparations are in use:—*

1. A tincture made by an alcoholic maceration of the fresh leaves.

2. A tincture made from the dry leaves by the same process.

*These preparations from France were actually on sale at the recent Adelaide Jubilee International Exhibition.

3. An alcoholic extract.
4. A wine.
5. A liniment prepared from the essence (*sic*).

It is interesting to note that the preparations used in Italy against the marsh fevers in Rome and its vicinity all come from a place called Tre Fontane, and have the form of a highly concentrated ethereal extract and an alcoholic elixir.

If a few drops of a Eucalyptus preparation are placed on the tongue a sensation of pungent freshness soon followed by one of warmth, is experienced, the latter being due to hyper-secretion of the salivary and buccal glands. Its ingestion into the stomach creates a similar sensation of warmth, and, besides, an emission of its characteristic odour by the mouth. The urine reveals a faintly violet colouration, indicating the passage of the drug through the system. . . . Larger doses of the drug produce headache, malaise, general fatigue and prostration, and, as shown by Gimpert, fatal results in animals, by paralysing the reflex motor centres of the spinal cord." *La France Medicale*, Nos. 43-5, 1885, quoted in *Therapeutic Gazette*, of Detroit, U.S.A.).

"An honourable and noteworthy rank as an auxiliary in miasmatic fevers is all that can with propriety be claimed for the preparations of Eucalyptus. . . . The statement that Eucalyptus exerts its antipyretic character also in the thermal elevations of tuberculosis and cancer, appears if true, all the more noteworthy, as its virtues in this direction have been most generally overlooked.

"Important as the antimiasmatic and general antipyretic properties of Eucalyptus* unquestionably are, it is in the laryngeal and bronchial inflammatory affections that the drug renders its most signal service. Its action in this respect rivals turpentine and tar, and offers even advantages in being better borne by the digestive organs and being more easily administrable.

* The oil is undoubtedly referred to here.

"Dr. Gimpert, of Cannes, the celebrated consumption specialist, believes it to be of benefit in tubercular diseases, but warns, however, against exhibiting the drug in too large doses, lest hæmoptysis should set in." (*La France Médicale*, *loc. cit.*).

The value of Eucalyptus oil in the various catarrhal affections of the urino-genital apparatus is likewise great. (I hope to deal with oils on a subsequent occasion).

Dr. Owen reports in the *Australian Medical Journ.* of September 15th, 1885, the case of a child 17 months old which was poisoned by drinking a few drops of Eucalyptus extract out of a supposed empty bottle. The symptoms were alarming, but the patient recovered under proper treatment.

Ramel is to be credited with having first suggested the idea of planting Eucalyptus trees in Europe, with the view of thus ridding territory from baneful marsh and malarial fevers. The same object led to its cultivation at the Cape. It was this ingenious transplantation of species of this genus to the vicinity of Rome that enabled the Trappists of Tre Fontane to recover and render habitable a vast area formerly exposed to the ravages of malaria. It is highly probable that the disinfectant power of the tree depends largely upon its capacity to absorb large quantities of water from the surrounding soil, and thus desiccate the germs of malaria.

Baron Mueller's services in forwarding the seeds of *E. globulus* and other species to the Trappist Fathers of Tre Fontane (through the late Archbishop Gould of Melbourne), must not be forgotten.

Those who care to further pursue the subject of Eucalyptus forests in regard to health, will find the matter discussed in some of its bearings in the learned Baron's *Eucalyptographia*; (where the hygienic properties of the trees are summed up), and in various other works and papers.

The subject of Eucalyptus preparations from a medicinal point of view has even now a voluminous literature.

Eucalyptus *kinos* are exceedingly astringent substances. The majority are ruby-coloured and soluble in water without turbidity.

They are really very valuable in cases where an astringent remedy is indicated, but as exposure to sunlight and moisture on the trees, for any length of time produces great alteration in their composition, disappointment may result if the following simple method be not resorted to in preparing a kino. Boil the kino with water, filter, evaporate to dryness by means of a water-bath. Keep the residue in a stoppered bottle not unnecessarily exposed to the light. The refined substance thus prepared will tend to have a constant composition. The dose is from 2 to 5 grains for an adult.

In Martindale and Westcott's "Extra Pharmacopœia," will be found a list of preparations in which Eucalyptus kino may be used. That of *E. rostrata* has been freely recommended by Mr. Bosisto of Melbourne, and is doubtless a valuable kino, but any of the clear, freely soluble kinos above alluded to can be used for all ordinary purposes.

A discussion and investigation of the properties of our numerous kinos is beyond the scope of this paper.

28. *EUGENIA JAMBOLANA*, Lam., (*E. Moorei*, F.v.M., in Muell. Cens., p. 59), N.O. Myrtaceæ, B.Fl., iii., 283.

A vinegar prepared from the juice of the ripe fruit is an agreeable stomachic and carminative; it is also used as a diuretic in India. The bark is a useful astringent. The expressed juice of the leaves enters into Indian medicine in various ways.

This tree is also found in Queensland.

29. *EUPHORBIA* spp.

It is stated that the natives of the Northern Territory use the juice of a species of *Euphorbia* as a specific in small-pox.

Another species affords a juice said to be a remedy in cancer. Without committing oneself to an expression of opinion as to the utility of the Euphorbias alluded to, it can be safely asserted that our native Euphorbias will doubtless well repay a thorough examination of their medical properties.

30. EUPHORBIA DRUMMONDI, *Boiss.*, N.O. Euphorbiaceæ, B.Fl., vi., 49.

Called "Caustic Creeper" in Queensland, and "Milk Plant" and "Pox Plant" about Bourke, New South Wales.

An alkaloid called "Drumine" has been extracted in Australia from this plant. It is said to have the same local action as Cocaine, but more extended experience will be necessary before its true value can be assigned.

Since the above was written, the so-called alkaloid has been examined in England and found to consist mainly of Calcium oxalate! (*Pharm. Journ.*, 7th Jan., 1888.)

No explanation has up to the present been vouchsafed in explanation of what is either crass ignorance, or trifling.

Some people contend that this plant contains no poisonous principle, yet cases of poisoning (chiefly of animals) seem without any doubt to have been traced to this particular plant. But perhaps its virulence only exists at a certain stage of its growth.

In western New South Wales the aborigines use an infusion or decoction of the plant in genital diseases, and use rather strong doses, but it is said that an overdose simply causes headache.

The late Mr. P. A. O'Shanesy observes (*Proc. Linn. Soc. N.S.W.* VI.) that this plant is said to be an infallible remedy in dysentery and low fever.

This plant is found in all the colonies.

[I am tempted to submit the information I have collected in regard to *E. pilulifera*, but in New South Wales localities it is probably introduced].

31. EVOLVULUS ALSINOIDES, *Linn.*, (*E. linifolius*, Linn. in Muell. Cens., p. 95.) N.O. Convolvulaceæ, B.Fl., iv., 437.

The stalk, leaves and roots are a reputed remedy in dysentery and fever. (Ainslie.)

This plant is found in all the colonies except Victoria and Tasmania.

32. *EXCÆCARIA AGALLOCHA*, *Linn.*, N.O. Euphorbiaceæ, B.Fl., vi., 152.

“River Poisonous-tree,” “Milky Mangrove,” “Blind-your-eyes.”

This tree produces by incision in the bark, an acrid, milky juice, which is so volatile, that no one, however careful, can gather a quarter of a pint without being affected by it. The symptoms are an acrid burning sensation in the throat, sore eyes and headache ; a single drop falling into the eyes will, it is believed, produce loss of sight. The natives of Eastern Australia, as well as those of New Guinea, &c., use this poisonous juice to cure certain ulcerous chronic diseases, e.g, leprosy ; but in Fiji the patient is fumigated with the smoke of the burning wood. (*Vide* Seemann, “*Flora Vitiensis*”).

In India the sap of the tree is called “Tiger’s Milk,” and is said to be applied with good effect to inveterate ulcers. The leaves also are used in decoction for this purpose. A good caoutchouc may be prepared from the milk.

This tree extends to Northern Australia.

33. *FLAGELLARIA INDICA*, *Linn.*, N.O. Liliaceæ, B.Fl., vii., 10.
“Lawyer Vine.”

The leaves are said to be astringent and vulnerary. This plant extends to Northern Australia, but is not endemic in Australia.

34. *FLINDERSIA MACULOSA*, *F.v.M.*, (*F. Strzeleckiana*, *F.v.M.* in Muell. Cens., p. 9), N.O. Meliaceæ, B.Fl., i., 388.

“Spotted or Leopard Tree.”

The clear gum of this tree is used by bushmen in the Western Districts as a remedy for diarrhœa. It is a gum of the Arabic class, and apparently nothing but its local abundance causes it to be singled out for this special use. Wattle gum is occasionally used for this purpose, and is more efficacious when slightly astringent by reason of included fragments of bark.

This tree is also found in Queensland.

35. *FRENELA ENDLICHERI*, *Parlat.* (*Callitris calcarata*, R.Br. in Muell. Cens., p. 109.), N.O. Coniferæ, B.Fl., VI., 238.)

"Cypress Pine," "Black Pine," "Red Pine," "Scrub Pine," "Murray Pine."

Mr. Bäuerlen informs me that the twigs of this tree are used in Northern Victoria and Southern New South Wales for mixing with fodder to expel worms in horses. See also *Boronia rhomboidea*.

This plant extends from Northern Victoria to Central Queensland.

36. *GEIJERA SALICIFOLIA*, *Schott*, N.O. Rutaceæ, B.Fl., i., 364.

"Balsam of Copaiba Tree," "Wilga."

The bark of this tree contains a powerful bitter, and has the odour of the drug from which it obtains one of its vernacular names.

It is also found in Queensland.

37. *GOODENIA* spp., N.O. Goodeniaceæ.

A species of *Goodenia* is supposed to be used by the native gins to cause their young children to sleep while on long journeys, but it is not clear which is used, or how it is administered. (Bailey.)

Many plants of this Natural Order contain a tonic bitter which does not seem to have been critically examined.

38. *GRATIOLA PEDUNCULATA*, *R.Br.*, and *GRATIOLA PERUVIANA* *Linn.*, N.O. Scrophularineæ, B.Fl. iv., 492-3.

The latter plant is called "Brooklime" or "Heartsease."

A decoction of these plants is used by people in the Braidwood district for liver complaints, with (many say) good results. They enter into domestic medicine for some complaint or other, in various parts of the colonies.

The latter plant is not endemic in Australia.

39. *GUILANDINA BONDUCELLA*, Linn. (*Cæsalpinia Bonducella*, Fleming, in Muell. Cens., p. 42), N.O. Leguminosæ, B.Fl., ii., 276.

I have never heard of any portion of this plant entering into Australian medicine, but as it is largely used in different parts of Asia some reference to it may be convenient.

The seeds are called "Molucca beans," and "Nicker or Bonduc-nuts."

The kernels of the nuts are very bitter, and are said by the native doctors of India to be powerfully tonic. They are given in cases of intermittent fevers, mixed with spices in the form of powder. Pounded and mixed with castor-oil they are applied externally in hydrocele. At Amboyna the seeds are considered anthelmintic, and the root tonic in dyspepsia. In Cochinchina the leaves are reckoned deobstruent and emmenagogue, and the root astringent. The oil from the former is used in convulsions, palsy, and similar complaints. (Drury).

They are frequently thrown up by the Gulf Stream on the shores of Scotland.

40. *HARDENBERGIA MONOPHYLLA*, Benth., (*Kennedya monophylla*, Vent. in Muell. Cens., p. 41), N.O. Leguminosæ, B.Fl., ii., 246.

Commonly, but wrongly, called "Native Sarsaparilla."

The roots of this plant are sometimes used by bushmen and others as a substitute for the true Sarsaparilla (*Smilax*), but its virtues are purely imaginary. It is also a common thing in the spring in the streets of Sydney to see persons with large bundles of leaves on their shoulders, doubtless under the impression that they have the leaves of *Smilax glycyphylla*.

This plant is found in all the colonies except Western Australia.

41. *HERPESTIS MONNIERIA*, *H.B. et K.* (*Bramia indica*, Lam. in Muell. Cens., p. 97), N.O. Scrophularinæ, B.Fl., iv., 491.

This small creeping plant is common to the tropical portions of both hemispheres. It is regarded by the Hindoos as a powerful diuretic and aperient, and the juice of the leaves, conjoined with petroleum, is used in India as a local application in rheumatism. "Whatever benefit is obtained from this formula is doubtless due to the petroleum." (*Pharm. of India.*)

42. *HYDROCOTYLE ASIATICA*, *Linn.*, N.O. Umbellifæræ, B.Fl., iii., 346.

In anæsthetic leprosy good results have followed the use of this herb, but it possesses no claim to the character of a specific attributed to it by some. It has been found more useful in secondary or constitutional syphilis, especially in those cases where the skin and subjacent cellular tissue are principally affected. In non-specific ulcerations, and in skin-diseases it is of value both as an internal and local remedy. (*Pharm. of India.*)

43. *INDIGOFERA ENNEAPHYLLA*, *Linn.*, N.O. Leguminosæ, B.Fl., ii., 196.

An infusion of the whole plant is diuretic, and as such is given in fevers and coughs in India. (*Ainslie.*)

It is also found in South Australia, and from New South Wales to Northern Australia.

44. *IONIDIUM SUFFRUTICOSUM*, *Ging.* (*Hybanthus enneaspermus*, F.v.M. in Muell. Cens., p. 6.) B.Fl., i., 101. See also Muell. Fragm., x. 81, where no less than 18 synonyms of this widely distributed species are given).

The leaves and tender stalks are demulcent; they are also employed when mixed with oil, as a cooling liniment for the head. The roots of this species are also used in India in diseases of the

urinary organs. (Ainslie). Other species are used medicinally in various parts of the world, and there is no doubt that the Australian species possess medicinal properties.

The present species is found in North and South Australia, and Queensland, in addition to this colony.

45. *IPOMÆA PES-CAPRÆ*, *Roitk.*, N.O. Convolvulacæ, B.Fl., iv., 419.

The boiled leaves are used externally as an anodyne in cases of colic, and in decoction in rheumatism; the juice is given as a diuretic in dropsy, and at the same time the bruised leaves are applied to the dropsical part. (Dymock, *Materia Medica of Western India*).

This plant is found in Western Australia, and from New South Wales to Northern Australia.

46. *JUSTICIA PROCUMBENS*, *Linn.*, N.O. Acanthacæ, B.Fl., iv., 549.

In South India the juice of the leaves squeezed into the eyes is a remedy in ophthalmia. (Drury).

This plant is found in all the colonies except Tasmania and Victoria.

47. *LAPORTEA GIGAS*, *Wedd.*, N.O. Urticæ, B.Fl., vi., 191.

“Giant Nettle.” “Irtaië” of the aborigines of the Richmond and Clarence. “Goo-mao-mah” is another aboriginal name.

The poisonous fluid secreted from the foliage is very powerful, particularly in the younger leaves, and their sting is exceedingly virulent, producing great suffering. Cattle become furious when they come into contact with the leaves.

It is stated that the pain caused by the sting of this plant will be instantly relieved by the milky juice of the lower part of the stem of *Colocasia macrorrhiza* being rubbed on the affected part. (*Proc. R.S. Queensland*, 1885).

This tree is also found in Queensland.

48. *MALLOTUS PHILIPPINENSIS*, *Muell. Arg.*, N.O. Euphorbiaceæ, B.Fl., vi., 141.

The reddish powder from the capsules of this plant, called "Kamala" by the Hindoos, is a useful vermifuge, especially adapted for the expulsion of *tænia*.

This tree extends to Queensland.

49. *MELALEUCA UNCINATA*, *R.Br.*, N.O. Myrtaceæ, B.Fl., iii., 150.

One of the common "Tea-trees." (Called "Broom" in South Australia, according to Mr. Tepper). It was formerly called "Yaang-arra" by the aboriginals of Illawarra.

According to Mr. J. G. O. Tepper (*Proc. R.S. S.A.*, iii., 174), the leaves of this plant, if chewed, are very useful in alleviating and curing ordinary catarrh. This observation is well worth repeating, especially as this particular species is widely distributed, and as there is no reason to suppose that this property is confined to this single member of a very large genus.

Found also in Western and South Australia, Victoria and Queensland.

50. *MELIA COMPOSITA*, *Willd.*, N.O. Meliaceæ, B.Fl., i., 380.

"Dygal" of the aboriginals of northern New South Wales. "White Cedar" and "Cape Lilac" of the colonists. Called "Persian Lilac" and other names in India.

The Hindoos use the flowers, fruit, leaves, and bark for many medical purposes. The root-bark is on the secondary list of the United States Pharmacopœia as an anthelmintic. In large doses it is said to produce narcotic effects, though these, if produced, pass off without injury to the system.

This tree extends from New South Wales to northern Australia.

51. *MENTHA GRACILIS*, *R.Br.*, N.O. Labiataæ, B.Fl., v., 83.

"Native Pennyroyal."

Mr. Bäuerlen points out that this plant and *M. satureoides* are used (in the southern districts of New South Wales at least) by

females in irregularities of the menses, with most satisfactory results. Either infusion or decoction is used. It should, however, be borne in mind that these two species are much more acrid than the European species of *Mentha* commonly used for a similar purpose, and therefore greater care should be exercised in their use.

Both herbs are strewn about floors and beds for the purpose of keeping away insects, and they are very efficient in driving away fleas and bugs.

Found in all the colonies except Western Australia and Queensland.

52. MESEMBRYANTHEMUM ÆQUILATERALE, *Haw.*, N.O. Ficoideæ, B.Fl., iii., 324.

“Pig’s face” (owing to the fanciful shape of the fruits). “Berurur” of the aboriginals of the Lachlan River.

Many species, and especially *M. acinaciforme*, Linn., from which this species scarcely differs, are used in South Africa. There the expressed juice of the succulent leaves taken internally checks dysentery, and acts as a mild diuretic, while it is also for its antiseptic property used as an excellent gargle in malignant sore throat, violent salivation, and aphthæ, or in the form of a lotion in burns and scalds. (Bailey in *Syn. Qd. Flora*).

This plant is found near the coast in all the colonies.

53. MUCUNA GIGANTEA, *DC.*, N.O. Leguminosæ, B.Fl., ii., 254.

Used in India in rheumatic complaints. The bark for this purpose is pulverised, mixed with dry ginger, and rubbed over the parts affected. (Rheede).

This plant extends from this colony to northern Australia.

54. MYRIOGYNE MINUTA, *Less.* (including *Centipeda orbicularis*, Lour. and *C. Cunninghami*, F.v.M., recorded by Baron Mueller in his “Census,” p. 84, as distinct species. See also Muell. *Fragm.*, viii., 143). N.O. Compositæ, B.Fl., iii., 553.

Called "Sneezeweed" in southern New South Wales.

The following letter from the Rev. Dr. Woolls (then of Richmond, N.S.W.), to the Editor of the "Sydney Morning Herald," appeared in that journal on Christmas Day, 1886. I give it in full, as if the plant only partially realizes the expectations formed of it, it will be a valuable addition to our indigenous vegetable *Materia Medica*.

"Some weeks since the Rev. S. G. Fielding, of Wellington, called my attention to a weed (known to botanists as *Myriogyne minuta* of the Composite Order), which he said had been used with success in cases of blight. Being anxious to test the efficacy of the remedy, and to ascertain whether any bad effects would arise from its application, I placed some of it in the hands of Dr. Jockel of this town, who has furnished me with the following remarks:—"I have much pleasure in testifying to the efficacy, in cases of ophthalmia, of the plant which you so kindly sent me. A case came under my notice a few days ago, of a drover who was suffering from a severe form of purulent ophthalmia, contracted up the country. I made an infusion of the plant according to the directions, and the first local application seemed to have almost a magical effect. The man expressed himself as relieved at once of the intense smarting which he had previously suffered. He got on so well that in two days he was able to start back up country again, and could hardly express his gratitude for the very great relief afforded. Louis C. Jockel."

"I find from a communication of Baron Mueller, that for some time past he has had an idea that *Myriogyne* might be used for medicinal purposes, and that he had actually submitted it to Dr. Springthorpe, an eminent physician in Melbourne, for purposes of experiment. The Baron however was not aware of its efficacy in simple ophthalmic inflammation, and he regarded the discovery as interesting. I mention this as a matter of justice to Dr. Jockel, who, I believe, is the first medical man in Australia who has proved the value of *Myriogyne* in a case of ophthalmia. This weed, growing as it does on the banks of rivers and creeks, and in

moist places, is common to all the Australian colonies and Tasmania, and it may be regarded as almost co-extensive with the disease which it is intended to relieve. In the document relating to the Intercolonial Exhibition of 1886-7, it is noticed as remarkable for its sternulatory properties, and recommended for the manufacture of snuff."

The Rev. Mr. Hartmann says (Brough-Smyth's "*Aborigines of Victoria*, ii., 173) that this plant is used as medicine by the aborigines of Lake Hindmarsh, but he does not say for what complaint.

Baron Mueller prepared a snuff from this plant many years ago.

This plant is also found in India, Madagascar and Japan. The natives of India consider it a hot and dry medicine, useful in paralysis, pains in joints, and special diseases; also as a vermifuge. (*Cyclop. of India.*)

55. PETALOSTIGMA QUADRILOCULARE, *F.v.M.*, N.O. Euphorbiaceæ, B.Fl. VI, 92.

"Crab tree," "Native Quince," "Emu apple," "Bitter bark," "Quinine tree." Called "Muntenpen" by some Queensland aboriginals.

The bark contains a very powerful bitter, said to have the same properties of Cinchona (Hill). Tenison-Woods, however, states (*Explorations in Northern Australia*) "It is usually covered with fruit like a small yellow plum, of eminently nasty taste. This is, I believe, its only claim to be called 'Quinine.'"

The stem-bark contains, together with the ordinary plant constituents, a camphoroidal essential oil, and an indifferent bitter principle belonging to the glucosides. (Falco, in Watt's Dict., vi., 1st Suppl., 904, where an analysis of the ash of the bark is also given).

This plant extends from New South Wales to Northern Australia.

56. *PIPER NOVÆ-HOLLANDIÆ*, *Miq.*, N.O. Piperaceæ, B.Fl., vi., 204.

“Native Pepper.”

An excellent stimulant tonic to the mucous membrane. Used by Dr. Bancroft, of Brisbane, in the treatment of gonorrhœa and other mucous discharges with considerable success.

This is one of the largest native creepers, the root being at times from six inches to a foot in diameter. The plant climbs like ivy to the top of the highest trees, and when full grown weighs many tons, so that a good supply of the drug is readily obtainable. The active principle, as dissolved out by ether, is a brownish, oily fluid, soluble in water to a limited extent only, the insoluble portion producing an oily emulsion. It has a warm, aromatic, pleasant taste, and a benumbing effect on the tongue when applied to it in minute quantity. (Bancroft.)

This plant is also found in Queensland.

57. *PITTOSPORUM UNDULATUM*, *Vent.*, N.O. Pittosporæ, B.Fl., i., 111.

“Native Laurel,” “Mock Orange.”

I am not aware that this plant is employed medicinally, but an interesting account (perhaps paving the way for its economic application) of *Pittosporine*, a bitter glucoside obtained from the bark by Baron Mueller and L. Rummel, will be found in Wittstein’s “Organic Constituents of Plants.” This tree is found in all the colonies except South and Western Australia.

58. *PLUMBAGO ZEYLANICA*, *Linn.*, N.O. Plumbagineæ, B.Fl., iv., 267.

In India, a tincture of the root-bark has been employed as an antiperiodic. Dr. Oswald states that he has employed it in the treatment of intermittents with good effect. It acts as a powerful sudorific. (*Pharm. of India.*)

It is a common medicine for dyspepsia in India. It is also frequently used as a poultice for abscesses.

It extends from New South Wales to Northern Australia.

59. *POLANISIA VISCOSA*, *D.C.* (*Cleome viscosa*, Linn. in Muell. Cens., p. 4), N.O. Capparideæ, B.Fl., i, 90.

This plant is used by the aborigines to relieve headache. (Mr. H. W. Stone, quoted by Mr. F. M. Bailey). It is also used in Cochin-China as a counter-irritant, in the same way as sinapisms in Europe, and also as a vesicant, and in the United States the roots are said to be used as a vermifuge. In India the leaves boiled in ghee (clarified butter) are applied to recent wounds, and the juice to ulcers. The seeds are occasionally given in fevers and diarrhœa. (Ainslie, Lindley).

This plant is found in all the colonies except Victoria and Tasmania.

60. *PORTULACA OLERACEA*, *Linn.*, N.O. Portulacaceæ, B.Fl., i., 169.

The common "Pig-weed" or "Purslane" of England.

This plant is a native of most warm parts of the world. It has been cultivated from very ancient times, and possesses antiscorbutic properties. The young shoots are sometimes put in salads, and the older ones are used as a potherb, or for pickling.

Found in all the colonies except Tasmania.

61. *PTERIS AQUILINA*, *Linn.* var. *ESCULENTA* (*P. esculenta*, Forst.), N.O. Filices, B.Fl. vii., 731.

"Brake Fern" or "Bracken."

The European plant is astringent, bitter and anthelmintic, and the rhizome has been used as a substitute for hops.

The Australian variety is found in all the colonies.

62. *RHIZOPHORA MUCRONATA*, *Lam.*, N.O. Rhizophoreæ, B.Fl., ii., 493.

A "Mangrove."

The bark has been tried medicinally in cases of hæmaturia, but with what result I have been unable to learn.

For notes on the medicinal utilization of the astringency of this tree, see *Pharm. Journ.*, vi., 11.

Found from this colony to Northern Australia.

63. *SARCOSTEMMA AUSTRALE*, *R.Br.*, N.O. *Asclepiadæ*, B.Fl., iv., 328.

Used by the Port Darwin natives as a remedy in small-pox. (Bailey). In the interior districts of New South Wales its milky juice is used by white men as an application to wounds.

Found in all the colonies except Victoria and Tasmania.

64. *SEBÆA OVATA*, *R.Br.*, N.O. *Gentianæ*, B.Fl., iv., 371.

This little annual can be utilized for its bitter, tonic principle. Uses same as *Erythraea australis* (q.v.).

This plant is found in all the colonies.

65. *SIDA RHOMBIFOLIA*, *Linn.*, N.O. *Malvaceæ*, B.Fl., i., 196.

"Queensland hemp." Called "Paddy Lucerne" on the Richmond and Clarence Rivers, New South Wales, and "Lucerne" in other parts of the colony (cows being very fond of it).

This herb is largely used by the natives of India in consumption and rheumatism. It is given as an infusion, and is said to promote perspiration, and the leaves are used as a poultice for snake-bites, and in cases of the stings of wasps and other insects. It contains a quantity of mucilage, which no doubt accounts for its use in the diseases of the chest. (*Pharm. of India*). In some parts of this colony the plant bears the name of "Jelly leaf," in allusion to its mucilaginous nature.

Found in South Australia, and from New South Wales to Northern Australia.

66. *SMILAX GLYCYPHYLLA*, *Smith*, N.O. *Liliacæ*, B.Fl., vii., 7.

"Native Sarsaparilla." "Sweet Tea."

This plant has been recommended as an alterative, tonic, and antiscorbutic. This is one of the earliest plants pressed into the

service of medicine in New South Wales. At p. 230, "*Journal of a Voyage to New South Wales*," by John White, Esquire, Surgeon-General to the Settlement, London, 1790 (the information must have been furnished almost immediately after the foundation of the colony), occurs the passage, . . . "good for the scurvy. The plant promises much in the last respect from its bitter as a tonic, as well as the quantity of saccharine matter it contains." The decoction is made from the leaves, and is similar in properties, but more pleasant in taste, than that obtained from the roots of *S. officinalis* or Jamaica Sarsaparilla. See a paper by Prof. Rennie of Adelaide, on *Glycyphyllin*, the sweet principle of this plant in *Journ. Chem. Soc.* Dec., 1886.*

The herb is a common article of trade amongst Sydney herb-alists.

Found also in Queensland.

67. *SOPHORA TOMENTOSA*, Linn., N.O. Leguminosæ, B.Fl. ii., 274.

"Sea-coast Laburnum."

Mr. F. M. Bailey states that the roots and seeds have been considered as specifics in bilious sickness.

This plant extends from New South Wales to Northern Australia, but it is not endemic in Australia.

68. *TABERNÆMONTANA ORIENTALIS*, R.Br., N.O. Apocynæ.

B.Fl., iv., 311.

"Bitter bark."

This small tree has an intensely bitter bark, and a decoction of it is sometimes sold as "bitters."

It extends from New South Wales to Northern Australia.

69. *TEPHROSIA PURPUREA*, Pers. N.O. Leguminosæ, B.Fl., ii., 209.

This plant is used in many tropical countries for the purpose of stupefying fish for the sake of capturing them.

* See also an investigation on the same substance by Mueller and Rummel in Wittstein's "Organic Constituents of Plants."

In India the plant is described as deobstruent and diuretic, useful in cough and tightness of the chest, bilious febrile attacks, obstructions of the liver, spleen and kidneys; the natives recommend it as a purifier of the blood, and for boils, pimples, &c. (Dymock).

Found also in South Australia, and in Queensland and in North Australia.

70. *TYPHA ANGUSTIFOLIA*, *Linn.*, N.O. Typhaceæ, B.Fl., vii., 159.

A "bullrush."

The root stock, which abounds in starch, is somewhat astringent and diuretic, and is employed in Eastern Asia in dysentery, gonorrhœa, and measles.

Found in all the colonies.

ON RHOPALOCERA FROM THE VICINITY OF MT.
BELLENDEN-KER, QUEENSLAND.

BY A. SIDNEY OLLIFF, F.E.S.,
MEM. DE LA SOC. ENT. DE FRANCE.

A small collection of butterflies, made by Messrs. E. J. Cairn and R. Grant, at Mount Bellenden-Ker, on behalf of the Trustees of the Australian Museum, is interesting, as we have at present no information as to the Rhopalocerous fauna of the locality. The collection contains twenty-seven species, of which the majority were obtained on the rich alluvial tracts in the vicinity of the mountain; a few of them, including *Epinephile Helena*, were found on the mountain itself, but unfortunately the exact elevations were not noted by the collectors.

Mt. Bellenden-Ker, attaining a height of 5,500 feet, is the highest point of the range, which is situated some distance south of Cairns.

The following is a list of the species obtained :—

<i>Danais plexippus</i> , Linn.	<i>Epinephile Helena</i> , Olliff.
<i>Euploea sylvester</i> , Fabr.	<i>Mycalesis terminus</i> , Fabr.
<i>Acraea andromacha</i> , Fabr.	<i>M. (Coenonympha) infuscata</i> , Macl.
<i>Atella propinqua</i> , Misk.	<i>Hypocysta irius</i> , Fabr.
<i>Argynnis inconstans</i> , Butl.	<i>Ypthima arctous</i> , Fabr.
<i>Junonia orithya</i> , Linn.	<i>Danis taygetus</i> , Feld.
<i>Precis zelima</i> , Fabr.	<i>Holochila absimilis</i> , Feld.
<i>Doleschallia australis</i> , Feld.	<i>Lycaena boetica</i> , Linn.
<i>Diadema alimena</i> , Linn.	<i>Terias</i> sp.
<i>D. bolina</i> , Linn.	<i>Delias nigridius</i> , Misk.
<i>Melanitis leda</i> , Linn.	

<i>Delias argenthona</i> , Fabr.	|	<i>Papilio erectheus</i> , Don.
<i>D. mysis</i> , Fabr.		<i>P. ulysses</i> , Linn.
<i>Eurycus cressida</i> , Fabr.		<i>P. egipius</i> , Misk.

It will be observed that the generic position of *Coenonympha infuscata* has been changed in the foregoing list. From an examination of the type from Cape York, in the collection of the Australian Museum, I have convinced myself that the species is referable to *Mycalesis*; it has the eyes hairy, and possesses, although indistinctly, the characteristic transverse band within the row of ocelli, and the tuft of hair near the base of the costa of the forewings.

SATYRIDÆ.

EPINEPHILE HELENA, sp.n.

Wings above dull brown. Forewing inclining to fulvous near the base, with a broad sulphurous fascia extending from beyond middle of costa to just before the posterior angle where it is suffused with fulvous; beyond this fascia the wing is dark brown; a black marking at the end of cell and another below cell between veins 2 and 3; a small minutely blue-centred ocellus near apex and another similar but larger ocellus near the margin between veins 2 and 3. Hindwing somewhat inclining to fulvous at apex and along outer margin; with two black ocelli, one near apex similar to but less distinct than those of the forewing, and one surrounded by a narrow orange ring near anal angle; along the outer margin are two indistinct lines of which the innermost is indentate. Under side pale slaty-brown, marked much as above. Forewing with an indistinct marking across cell just before the middle; apical ocellus encircled with orange. Hindwing with two brown narrow fascia-like markings, one near the base crossing cell, the other extending from middle of costa to near anal angle, avoiding the cell; both ocelli encircled with orange. Cilia fuscous. Exp. 62 mm.

Mt. Bellenden-Ker, Queensland (about 3,000 feet).

This species may be distinguished from its nearest ally, the common *Epinephile abeona*, Don., by the position of the fascia on the forewing which is situated between, instead of behind the ocelli; apart from this it is smaller in size, paler in colour, and has the ocelli less conspicuous. Judging from the description it appears to have little resemblance to *E. Rawnsleyi** from the Maroochey River, near Brisbane. Mr. G. Barnard informs me that he found *E. Helena* near the Barron Falls, Cairns, at an elevation of about 1,500 feet above the sea.

In conclusion, I have only to add that the species is dedicated to Mrs. Edward Forde, a lady whose practical knowledge of the economy of the larger native lepidoptera is probably unequalled, and who is widely known for her admirable drawings in the 'Australian Lepidoptera,' the work of her father the late Mr. A. W. Scott.

* Miskin, Trans. Ent. Soc. Lond. 1876, p. 454.

ON A NEW TRILOBITE FROM BOWNING.

BY JOHN MITCHELL.

[Plate xvi. (of Vol. II. (2)), figs. 7-12].

ACIDASPIS LONGISPINIS, n.sp.

Head-shield sub-semicircular, rather flattened in front, sparingly granulated.

Glabella less complicated than it usually is in members of this genus; the central lobe somewhat oblong in shape, moderately arched, and having on each side of it four tuberos elevations separated from it by fairly defined grooves, and from each other by shallow depressions. The anterior and posterior swelling on each side is much less than the medial two on each side. From the neck extend two long spines which appear to be equal in length to that of the thorax and pygidium taken together, if not actually longer. The eye-lobe is sharply angular; the facial suture from the eye to the front margin almost straight, making with it an angle of about 120° ; the posterior portion straight, cutting the base of the glabella at the outer margin and making with it an angle of about 45° . Along the anterior lines of the facial sutures the edges of the glabella seem to be bifurcate, forming a kind of socket for the free cheek to rest in.

The free cheeks bear very large spines at their genal angles; the outer margins slightly flattened, and extending from the front towards the eye three rows of regularly placed granulations are visible.

The eye is almost sessile, conoid, and faceted, the latter feature being remarkable. The posterior edge of the cephalic-shield along the line of articulation with the thorax thickens towards the extremities.

Thorax with the axis prominent and about as wide as the side-lobes, nearly as wide as long, and as far as can be seen from the specimens yet obtained consisting of nine segments, no granulation noticeable probably from imperfect preservation, axial groove not defined, or may be said to be absent. At its extremity each pleura carries an abnormally large spine exceeding four times its own length; the anterior edge of each pleura is continued into a somewhat paddle-shaped appendage which bears the appearance of having been articulated near the middle. The spines are directed backwards increasingly from the first to the last, so that those from the 7th, 8th, and 9th pleuræ on each side are parallel with the axis. At its articulation with the cephalic-shield the thorax is less wide than the shield; but at the third segment their transverse measurements are equal. The pleuræ prominently ridged; at their junction with the axis curved forward, compressed laterally, swollen and have between each a rather deep depression forming an interrupted axial groove.

Pygidium triangular, two and a-half times as wide as long, side lobes equal in length, granulation distinct; axis prominent, two-thirds the length of pygidium, no true segmentation but crossed by one raised arch; side-lobes undivided, traversed by two pairs of lateral elevations or pads, one along the front edge, the other pair from the ring of the axis, one from each side, which curve backwards and cut the margin of each side-lobe approximately at one-third of the lobe's marginal measurement, *i.e.*, they divide each lobe into two portions, so that at the edge the anterior portion is one-third of the other. From these two elevations project two spines, inclining towards each other, and not so proportionately large as those of the pleuræ, or genal angles. These are the only spines on the pygidium. The lobes are flat, but for the elevations just referred to, except along the edges which are slightly curved downwards. The larger granulations appear to be in rows.

The prominent features of this species are its very large spines, faceted eyes, and the paddle-shaped attachments to the pleuræ, which distinguish it from all the species of *Acidaspis* that I am

acquainted with. Because of its immense spines Mr. Etheridge, Government Palæontologist, suggested the specific name *longispinis*, which I have adopted.

The stratigraphical range of the species is rather extensive, as it makes its first appearance in the Phacops or Middle Trilobite Bed of the Bowring series, and again in the Upper Trilobite Bed, which represents a sedimentary deposit of 1000-1500 ft. in thickness. Only two species of *Phacops* (like *P. caudatus*, and *P. fecundus*), and another *Acidaspis* continue with the same persistency, and these are its associates in both beds. In the Phacops Bed it is also associated with *Proetus Bowringensis*,* and the other trilobites said to be associated with this species in its description. In the Upper Bed it is associated with *Cyphaspis Bowringensis*, &c.

The largest specimens would appear to reach a length of $2\frac{2}{3}$ inches. The largest specimen (fig. 12) I have obtained for six segments of the thorax and head gives a length of $1\frac{2}{3}$ inches, of which the head measures $\frac{2}{3}$ inch, and the 6 segments 1 inch. Allowing $\frac{1}{2}$ inch for the three missing segments and $\frac{1}{2}$ inch for the length of pygidium would give the length as above for the complete specimen.

In Proc. Linn. Soc. N.S.W. (2), II., two very imperfect heads of this species are figured by M. Ratte, Geologist Aust. Mus.

EXPLANATION OF FIGURES.

PLATE 16, VOL. II, (2 SER.), PART 4, 1887.

Fig. 7.—Head of small specimen. Nat. size.

Fig. 8.—Pygidium „ „ Nat. size.

Fig. 9.—Free cheek with eye. Nat. size.

Fig. 10.—Pleura with spine and appendage from below. Nat. size.

Fig. 11.—Young imperfect specimen. $\frac{2}{3}$ Nat. size.

Fig. 12.—Fragment of large specimen slightly reduced.

*In describing this species I inadvertantly stated that it was obtained from the Lower Trilobite Bed, instead of from the Phacops Bed; and failed to notice the error when the proof of the paper was submitted for correction.

NOTES AND EXHIBITS.

Mr. Fletcher exhibited flowering specimens of *Vallisneria spiralis*, Linn., and *Symphyonema paludosum*, R. Br., collected at Botany on the occasion of the excursion on Saturday last; in reference to which Rev. Dr. Woolls, who was one of the party, writes "I cannot find any record of *V. spiralis* having been found near Sydney, with the exception of a passing notice in Dr. Bennett's *Wanderings of a Naturalist*, p. 282, where he alludes to the large form found in the Nepean; and then speaks of two smaller species as occurring in the vicinity of Botany swamps. Brown and Sieber are said to have found *S. paludosum* at Port Jackson, but I think it is rare in the neighbourhood of Sydney."

Dr. Katz read the following note :—

"Permit me to touch upon a subject of more than usual interest, namely, that of the nature of the venom of Australian snakes. A number of valuable observations have been made upon the venomous snakes of other countries, such as Asia (India) and America; but as yet comparatively little exact information is to hand as to the character of the venom of snakes from Australia. Chiefly at the instigation of the Hon. William Macleay, I have taken up the subject under consideration, and I have already been enabled to experiment on guinea-pigs with the venom of the Brown-banded or Tiger-snake (*Hoplocephalus curtus*, Schleg.). It is not my intention to give here the results of these experiments which are still incomplete, but to point briefly to what it would seem highly desirable to know, from a practical point of view, as well as from a merely scientific one. We may reasonably ask—what is the chemical composition of the virus of Australian venom-snakes, and what are its poisonous principles? That the effect of the poison depends on the existence of such chemical compounds, and not on micro-organisms, needs no

explanation when we see a guinea-pig die within two minutes after having been bitten by a tiger-snake; nor is there, for obvious reasons, the slightest occasion to suppose that the poisonous matter in snakes is the product of some bacterial life. The physical part of the investigation has to deal with the effect of various agents, such as temperature, light, chemicals, on the venom of different species; physiologically, it should be ascertained how and where the venom acts; whether there are antidotes; whether animals can be rendered immune from snake-bite by previous inoculation with minute quantities of venom from the same or another species; whether or how the degree of strength of the poison differs according to the different species. The fact published by Sir J. Fayrer, that the blood of an animal dead of snake-poison is fatal to other animals, does not seem to hold true with reference to the poison of the Tiger-snake, in so far as two experiments in this direction yielded negative results. Such experiments naturally require repetition under varied aspects. The first condition, of course, for a successful carrying-out of the investigations referred to, is to have a sufficient supply of material. I should therefore be glad to receive from Members any contributions in the shape of living snakes or of the dry venom."

Mr. A. Sidney Olliff exhibited *Schizorrhina emilia*, White, a species of Cetoniidæ which had not hitherto been recorded from Australia, although well-known and widely distributed in the islands of the S. and S.E. Pacific. The specimen had been taken at Cairns, Queensland, by Captain Wensley Peel.

Mr. Olliff also showed the new butterfly described in his paper.

Mr. Palmer exhibited (1) a young fish (Family *Mugilidæ*) from a pond at Burwood; (2) a viviparous lizard [apparently *Lygosoma (Omolepida) casuarinæ*] which brought forth six living young ones, three on each of two consecutive days; and (3) a remarkable Mogo or stone-axe from Campbelltown.

Mr. A. J. North, F.L.S., exhibited a series of the eggs of the following birds :—*Anous stolidus*, Linn. ; *A. melanogenys*, G. R. Gray ; *A. cinereus*, Gould ; *Sterna fuliginosa*, Gmel. ; *Gygis candida*, Gmel. ; *Phaëton rubricauda*, Bodd. ; *Puffinus sphenurus*, Gould ; *P. assimilis*, Gould ; *Sula personata*, Gould. For these eggs Mr. North stated that he was indebted to our energetic member, Dr. P. H. Metcalfe, who collected them on Nepean, Philip, and Norfolk Islands, and by whom also they had been fully described in a most interesting and exhaustive paper contributed to the "Ibis" for 1885 (Vol. III., Fifth Series).

WEDNESDAY, 25TH APRIL, 1888.

The President, Professor W. J. Stephens, M.A., F.G.S., in the Chair.

Mr. C. A. Topp, M.A., F.L.S., Warden of Melbourne University, Dr. R. Vandeleur Kelly, and Mr. Gisbert Drees were introduced as visitors.

The President announced with great regret that telegraphic information had reached Sydney of the death of one of our Honorary Members, Baron N. de Miklouho-Maclay.

Also, that no excursion will be held during the ensuing month.

DONATIONS.

"The Quarterly Journal of the Geological Society of London." Vol. XLIV., Part 1, No. 173 (1888). *From the Society.*

"Journal of the Royal Microscopical Society, London, 1887." Part 6a. *From the Society.*

"Entomologisk Tidskrift." Arg. VIII., Häft. 1-4 (1887). *De la part de la Société Entomologique de Stockholm.*

"Proceedings of the Cambridge Philosophical Society." Vol. VI., Part 3 (1887). *From the Society.*

"Report of the Auckland Institute and Museum for 1887-8." *From the Institute.*

"The Journal of the Cincinnati Society of Natural History." Vol. X., No. 4 (1888). *From the Society.*

"Bulletin of the Museum of Comparative Zoology at Harvard College." Vol. XIII., No. 6 (1887). *From the Museum.*

"The Characeæ of America." Part I. By Timothy F. Allen, M.D., L.L.D. *From the Author.*

"Zoologischer Anzeiger." XI. Jahrg., Nos. 272 and 273 (1888). *From the Editor.*

"Feuille des Jeunes Naturalistes." No. 209 (March, 1888). *From the Editor.*

"Abstracts of Proceedings of the Zoological Society of London" (21st Feb., and 6th March, 1888). *From the Society.*

"The Journal of Conchology." Vol. V., No. 9 (1888). *From the Conchological Society of Great Britain and Ireland.*

"Mittheilungen aus der Zoologischen Station zu Neapel." Band VII., Heft 3 and 4 (1887). *From the Zoological Station.*

"Proceedings of the Royal Society, London." Vol. XLII., Nos. 256 and 257; Vol. XLIII., Nos. 258-261 (1887). *From the Society.*

"The Victorian Naturalist." Vol. IV., No. 12 (April, 1888). *From the Field Naturalists' Club of Victoria.*

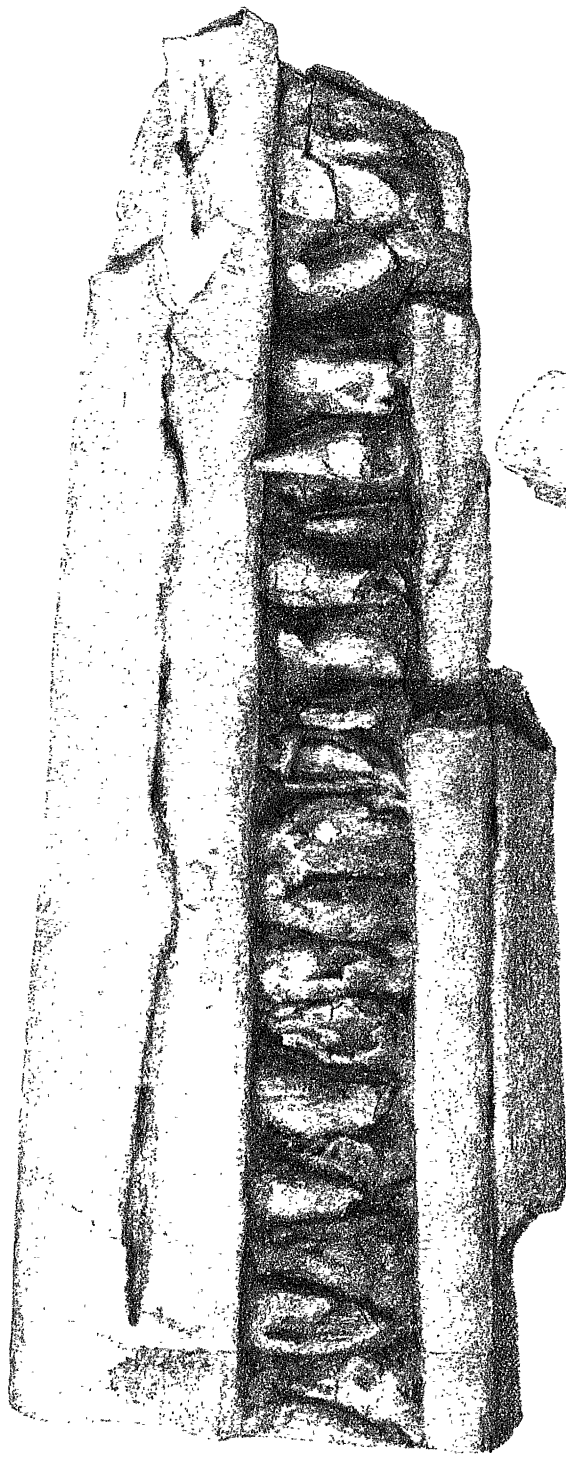
"Archives de Biologie." Tome VII., Fascs. 2 et 3 (1887). *From the Hon. W. Macleay, F.L.S., &c.*

"Bulletin de la Société Royale de Géographie d'Anvers." Tome XII., Fasc. 3 (1888). *From the Society.*

"Sydney Free Library, Report of Trustees, 1887-88." *From the Trustees.*

"Annalen des K. K. Naturhistorischen Hofmuseums, Wien." Band II., No. 3 (1887). *From the Director.*

"The Australasian Journal of Pharmacy." Vol. III., No. 28 (April, 1888). *From the Editor.*



1. (3/4 Nat. Size).



2. (1/2 Nat. Size).



3. (1/2 Nat. Size).

PAPERS READ.

ON ADDITIONAL EVIDENCE OF THE GENUS
ICHTHYOSAURUS IN THE MESOZOIC ROCKS
("ROLLING DOWNS FORMATION") OF NORTH-
EASTERN AUSTRALIA.

BY R. ETHERIDGE, JUN.,

PALÆONTOLOGIST TO THE AUSTRALIAN MUSEUM, AND GEOLOGICAL
SURVEY OF NEW SOUTH WALES.

(Plate VII.)

The only remains of *Ichthyosaurus* so far recorded from the Mesozoic rocks of Australia, are those to which Prof. F. McCoy applied the name of *I. Australis* at the time of his first announcement of the discovery of Enaliosaurian Reptiles in Northern Queensland.* The fossils in question were obtained at the base of Walker's Table Mountain at the head of Flinders River, and consist of the hinder portion of the head, numerous vertebræ, a paddle, &c., casts of which can be seen in the Australian Museum.

The interesting fragment now brought under notice is the snout or fore part of the skull of an *Ichthyosaurus*, and is, I believe, the first of its kind yet discovered in Australia.

It is from Marathon Station, and I am indebted to the kindness of Mr. de Vis for an opportunity of describing it. I believe it forms a part of the Palæontological Collection of the Queensland Museum.

The fossil consists of that part of the upper and lower jaws of a large skull anterior to the nostrils. It measures ten inches in length, and exhibits the greater portion of the right maxillary and

* Trans. R. Soc. Vict., 1868, VIII., p. 42.

dentary bones, and a portion of the left. At the anterior end the specimen has been broken-off short, immediately posterior to the union of the rami, and at the hinder end just anterior to the outer termination of the nasal bones. At the former the snout is $3\frac{1}{2}$ to 4 inches in transverse measurement, and at the latter point $4\frac{1}{2}$ inches. There are thirty teeth in all preserved, ten implanted in the pre-maxillary, and eleven in the dentary.

Both bones are longitudinally channelled by a deep semi-interrupted groove, similar to that seen in other species of *Ichthyosaurus*.

The teeth are of medium size, but larger than in some species, measuring from 1 to $1\frac{1}{4}$ inches from the alveolar edge to the apex of the crown, but including the implanted base, one of the foremost teeth measures $1\frac{3}{4}$ inches in length. They increase in diameter and stoutness from before backwards, are conical sub circular in section, with a non-trenchant, and apparently straight crown. The enamel is ornamented with grooves and ridges, but there is no evidence that the crown apices were devoid of these; but on the contrary, the upper portions of the crown and the base of the teeth above the alveolus, appear to be more strongly ridged than does the middle line of each tooth. In the most anterior tooth but one preserved in the pre-maxillary having a sectional diameter of half an inch, there is a pulp cavity of three-sixteenths of an inch.

In a transverse section of the posterior end the following facts are discernible. The breadth of the pre-maxillary across the top of the alveolar cavity is 1 inch. On the outer border the external groove traversing this bone longitudinally leads into a well-marked cavity, the exterior alveolar wall being thin, but this is perhaps owing to some extent to the lateral abrasion the specimen has undergone. The alveolus cut by the section is five-eighths of an inch wide, and 1 inch in depth. From the thickened and enlarged lower end the inner wall of the bone is directed upwards in a fairly straight line until it reaches a point on a level with the upper end of the alveolus. Here it takes a well-marked

bend inwards to above the cavity of the external groove ; thence it bends outwards to become the median surface for union with that of the left pre-maxillary. The inner alveolar wall descends at last four-eighths of an inch lower than the outer one. There is no indication of the nasals. In the lower jaw the lower portion of the dentary is not preserved, having flaked-off from the specimen, but this bone would probably present a deeply sigmoidal outline if whole. It now measures through the base of the alveolus $1\frac{1}{8}$ inches, the latter being six-eighths of an inch deep. From the bottom of the alveolus through the inner portion of the dentary there is only a thickness of three-sixteenths of an inch. The upper element of this bone is nearly as correspondingly thick as the lower portion of the pre-maxillary, whilst that part below the alveolus, including the portion split off is at least one inch in height. The external longitudinal groove leads into a sac, which with the passage uniting the latter to the outer groove almost completely cuts the bone in half, and strongly resembles the similar vascular canal in the pre-maxillary. We also notice in this section the difference in the angle of the alveolus in the upper and lower jaws, and doubtless the curved outline of the lower teeth is a provision of nature to bring them into apposition with those of the upper jaw, which are straighter and set at an entirely different angle.

I do not see any trace of the splenial bones, the fracture which severed this portion of the jaws from the remainder of the head having taken place too far forward ; unless the small fragment of bone at the very bottom of the section, in the middle line, represents the anterior termination of the right splenial.

Since Prof. McCoy's first announcement of Enaliosaurian remains in Queensland, very little seems to have been done towards working out the distribution of this important group of Reptiles in Australia. The details of his *Ichthyosaurus Australis* given by McCoy are so meagre, that it is with the greatest difficulty a comparison can be instituted with any other remains. The presence of the casts in the Australian Museum would have rendered this task easier than it otherwise could have

been, had that portion of the head mentioned by McCoy as bearing teeth been present; but the cast in the Museum consists of a portion of the right side included between the posterior margin of the orbit to about half the length of the nostrils, measuring 1 foot in length, by $7\frac{1}{2}$ inches high. This portion of the cranium is of course much posterior to that here described, but judging from the relative proportions of the two specimens I am inclined to regard the present fragment as a portion of a species quite as large as Prof. McCoy's, and it is possible they may be identical. But until we know more of these old Australian forms it will be found convenient, for the sake of distinction, bearing in mind the foregoing facts, to catalogue the present example as *Ichthyosaurus Marathonensis*.

The general proportions of this snout resemble those of *I. campylodon*, Carter, from the English Chalk, and there is present in this species a well-marked vascular channel* along the pre-maxillary and dentary bones, just as we see it here. Describing this, Sir Richard Owen says—"Opposite the origin of the inner alveolar plate the pre-maxillary is traversed by a straight longitudinal groove, 4 lines in breadth, which contracts as it advances forwards."† Touching the similar groove seen along the dentary, he adds—"The outer part of the dentary at the hinder fracture is 6 lines in thickness, smooth and convex on its outer side, which is traversed by a longitudinal groove, which also slightly narrows as it advances."

As well as in *I. campylodon*, this groove is shown in Prof. Owen's figures of the jaws of *I. communis*‡ and *I. platyodon*,§ Liassic species.

McCoy notes the resemblance of the teeth of his *I. Australis* to those of *I. campylodon* previously referred to, a likeness which is also perceptible in our species. I am unable, however, to institute

* Mon. Foss. Rept. Cret. Form. 1851, t. 25, fig. 1 g.

† *Loc. cit.*, p. 75.

‡ Mon. Foss. Rept. Liassic Form. t. 24, f. 2.

§ Mon. Foss. Rept. Liassic Form. t. 31, f. 2.

a comparison between the latter and *I. Australis*, from the fact that the casts in the Australian Museum do not exhibit the teeth.

The upper surface of the pre-maxillary, judging from the section of the right one, would form rather a narrow arch, differing very much in this respect from the broad semi-circular outline of *I. campylodon*.

In describing the Fossil Reptilia of New Zealand, Sir James Hector, F.R.S., has applied the name of *Ichthyosaurus Australis** to some remains found in that country. Prof. McCoy's name having priority, that of the New Zealand species will need alteration.

Locality and Horizon. — Marathon Station, North-Central Queensland; "Rolling Downs Formation" (*C. de Vis, Esq.*).

EXPLANATION OF PLATE.

Fig. 1. A general view of the snout of *Ichthyosaurus Marathonensis*.

Fig. 2. One of the teeth ($\times 2$).

Fig. 3. Transverse section of the posterior end (nat. size).

* Trans. N. Zealand Inst. for 1873 [1874], p. 355.

ON ADDITIONAL EVIDENCE OF THE OCCURRENCE
OF *PLESIOSAURUS* IN THE MESOZOIC ROCKS
OF QUEENSLAND.

BY R. ETHERIDGE, JUN.,

PALÆONTOLOGIST TO THE AUSTRALIAN MUSEUM, AND GEOLOGICAL
SURVEY OF NEW SOUTH WALES.

(Plate VIII.)

In continuation of my researches amongst the Mesozoic Reptilia of Queensland, I have now the honour to bring under the notice of the Society portions of disunited, but at the same time intermingled vertebræ of a *Plesiosaurus*, from the "Rolling Downs Formation" of the Walsh River. As originally received from Mr. C. de Vis, to whom I am again indebted for the loan of the specimen, the latter was almost completely embedded in the nodular blue-drab impure limestone of that locality, and has been worked out by Mr. W. Cornick, the Assistant to the Taxidermist of the Australian Museum.

In this mass we have the remains of at least four vertebræ, which, judging from the form and attached processes, are clearly those of the dorsal series. Only one, however, is in any degree perfect, the others having undergone fracture, and all abrasion. Intermingled with the vertebræ are portions of ribs, particularly two well-marked fragments, and an articular end of a third.

The most perfect vertebra is $5\frac{1}{4}$ inches high, but the inferior margins of the centrum are not preserved, so that this measurement is somewhat under that of the perfect size of the bone. The edges of the articular surfaces are much worn and decorticated, but as preserved the entire centrum is $1\frac{1}{2}$ inches in height, and the concave articular surface $1\frac{1}{4}$ inches. The length of the centrum, fore and aft, is $1\frac{3}{4}$ inches, and the breadth or width, 2 inches. The





4. (Nat. Size)

2. ($\frac{3}{4}$ Nat. Size)

neural spine from the upper margin of the canal, in the middle line, is $3\frac{3}{4}$ inches in height, but is shortened by fracture; it is sharp, thin, and laterally compressed. At its base the spine is $1\frac{1}{2}$ inches thick, from before backwards, but at the broken upper extremity, the transverse width is a little less than 1 inch. It is very erect, and does not appear to have any posterior inclination, but the posterior zygapophysis would overhang the succeeding centrum to a slight extent when in apposition with it. The neural canal itself is broadly oval, measuring 1 inch in its longest diameter; but the prezygapophysis is not preserved. The diapophysial support of the rib visible, is placed very high up, and is directed backwards and upwards, and forms the entire costal surface; below this point the surface of the vertebra is much hollowed. The diapophysis is ledge-like, flattened to some extent above and below, with the ridge connecting its under portion to the lateral surface of the centrum very ill-defined. The actual surface for the rib articulation is not preserved through fracture.

The remains of the ribs consist either of portions of two, or else one broken in half, with the severed ends contiguous to one another. One of these pieces is 6 inches in length, the other $6\frac{1}{2}$ inches, the former practically straight, the latter curved, and both laterally compressed. When united these would represent a rib from 13 to 14 inches long. The third example previously referred to, represents the proximal end of a rib, with a simple expanded termination about $\frac{3}{4}$ of an inch in diameter.

Taking into consideration the general characters of these bones, and the position of the diapophyses, little doubt can be entertained that we are dealing with vertebræ of the dorsal series. In describing those of *Plesiosaurus dolichodeirus*, Conyb., Owen says—"The transition from the cervical to the dorsal series is effected by the usual elevation of the costal surface by gradational steps, continued through about five vertebræ, until a single costal surface is presented by a large diapophysis from the neural arch."* This

* Mon. Foss. Reptilia Lias. Form. 1865, pt. 1, p. 6.

is precisely what we have here, the diapophysis assuredly having reached its definite elevation. Again, if I am right in conjecturing that the two pieces of rib appertain to one, the sum of these characters would seem to indicate the middle of the dorsal series as the position to be occupied by the present bones when *in situ* in the column.

Little can be said as to the specific identity of these vertebræ. The remains of two species of *Plesiosaurus* have been described from Queensland:—

P. macrospondylus, McCoy. — Cervical vertebræ with very rugose articular surfaces to the centrum.

P. Sutherlandi, McCoy. — ‘Trunk’ vertebræ, having the centum $2\frac{1}{4}$ inches long, by $3\frac{3}{4}$ inches wide, by $2\frac{1}{2}$ inches deep.

As regards the first of these vertebræ, they are, so far as discovered, cervical, but if the dorsal are similarly rugose, the bones now under description must be distinct. In connection with *P. Sutherlandi*, the word trunk would lead one to infer that dorsal vertebræ are probably meant, as distinct from cervical and caudal; if so, the measurements are quite different from those of the present specimens.

Several species have been described from the Mesozoic rocks of New Zealand, by Sir R. Owen, F.R.S.,* and Sir James Hector, F.R.S.;† but I am unable to satisfy myself of the identity of the present specimens with any of them. Two, *P. Australis*, Owen, and *P. crassicostatus*, Owen, appear to be well known. The first is distinguished by the general character of its vertebræ; those of the second by the presence of a very large central tubercle. The four others we are less acquainted with, and a comparison without actual specimens becomes very difficult. Two, *P. Hoodi*, Hector, and *P. Holmesii*, Hector, are known only by cervical vertebræ; whilst of the two others, *P. Traversi*, Hector, and *P. Mackayi*, Hector, we are only acquainted with cervical vertebræ and portions

* Report Brit. Assoc. 1861, p. 122; Geol. Mag. 1870, p. 52.

† Trans. N. Zealand Institute for 1873 [1874], p. 333.

of the lower jaw of the first, and general fragments of the skeleton of the second. Under these circumstances, as I am unable to make as minute comparisons as should be done, a distinctive name is not applied to the fossils now under consideration.

Locality and Horizon. — Walsh River, North Queensland ;
"Rolling Downs Formation" (*C. de Vis, Esq.*)

EXPLANATION OF PLATE.

Fig. 1. General view of the bones, showing lateral aspect of the best-preserved vertebra and portions of ribs.

Fig. 2. Anterior view of same vertebra.

NOTES ON THE NIDIFICATION OF *RHIPIDURA PREISSI*, CABANIS, AND *MALURUS PULCHERRIMUS*, GOULD.

BY A. J. NORTH, F.L.S.

Through the courtesy of the Hon. Wm. Macleay I have been permitted to examine a small collection of nests and eggs recently procured by his collector, Mr. W. W. Froggatt, about one hundred miles inland from Derby, North-Western Australia. I am indebted to Mr. Froggatt for all data relative to the taking of them. Amongst others procured are those of *Collyriocinclla brunnea*, Gould; *Rhipidura preissi*, Cabanis; *Malurus pulcherrimus*, Gould; *Malurus cruentatus*, Gould; *Stictoptera annulosa*, Gould; and *Poephila acuticauda*, Gould; several of which I described in a former paper.

RHIPIDURA PREISSI, Cabanis.

Mr. Froggatt found a nest of this species built in a climbing plant growing on the banks of the Fitzroy River, about twenty-five miles inland from Derby, on the 25th of September, 1887; it is very like that of its near ally, *R. albiscapa*, of the eastern and southern portions of the continent, but much smaller, resembling in shape a miniature wine glass with the base broken off. The nest is composed of shreds of thin fibrous bark and fine grasses, held together on the outside with spiders' webs, which are neatly wound round the exterior surface of the nest, and the thin branch on which it is placed, the stem of the nest having a somewhat ragged appearance at the extremity. Exterior diameter 1·7 inch, depth 1·67 inch, length of stem from the bottom of the nest proper and branch on which it is placed 2·25 inches. Interior diameter 1·58 inch, depth 1·2 inch. The rim of the nest is very thin. Eggs two in number for a sitting, of a creamy-white

ground colour, spotted and blotched with dull wood-brown, intermingled with obsolete markings of slaty-grey which are more thickly disposed towards the larger end where an ill-defined zone is formed. Length (A) 0.6×0.48 inch ; (B) 0.63×0.5 inch.

MALURUS PULCHERRIMUS, Gould.

A nest of this species found on the 25th of January, 1888, in a low bush on the Napier Range, about one hundred miles inland from Derby, is similar to those of other members of the genus, being a dome-shaped structure, outwardly composed of long thin strips of bark, matted together with spiders' cocoons, and lined inside with the soft downy seeds of a composite plant. It contained three eggs in an advanced state of incubation, oval in form, white, sprinkled all over the larger end with reddish-brown markings. Length (A) 0.68×0.48 inch ; (B) 0.68×0.45 inch.

NOTES ON SOME OPHIDIANS FROM KING'S SOUND,
NORTH-WEST AUSTRALIA.

BY WILLIAM MACLEAY, F.L.S.

The snakes collected by Mr. Froggatt in the vicinity of King's Sound during last year consisted of six species only, but of these two species are undoubtedly new.

Those previously described are—

NARDOA GILBERTI, Gray. Two specimens.

BRACHYSOMA SIMILE, Macleay. One specimen.

PSEUDECHIS DARWINIENSIS, Macleay. Two specimens.

ACANTHOPHIS ANTARCTICA, Wagler. One specimen.

The specimen of *Acanthophis* is very young, too young for proper determination, and may be distinct from the *Antarctica* of the eastern parts of Australia. I find that the number of sub-caudal shields in *Pseudechis Darwiniensis* is very variable in the two specimens got by Mr. Froggatt; one numbers 39 entire and 15 double sub-caudal plates, the other 34 entire and 30 double. The following are new species :—

DIPSAS ORNATA, n.sp.

Scales in 15 rows.

Anal plate entire.

Abdominal plates, 277.

Sub-caudals, 120/120.

Total length, 4 feet.

Head, 1 inch.

Tail, 9 inches.

Head broad, flat, rounded at the muzzle, and very suddenly contracted behind into a very narrow neck. Body elongate, compressed, almost keeled along the centre of the back, and tapering to a very long fine tail. The mouth is much curved, there are nine upper and ten lower labials, the loreal is nearly square, the anterior ocular is large, and the two posterior oculars small. The colour is yellowish-white, closely banded with broad black fasciæ from the head to the extremity of the tail; these fasciæ are less continuous on the neck and upper parts, and assume the form of large spots, and even on the hinder parts of the body they are a little interrupted; they all slope a little backwards, and are never continued on the ventral plates. The most remarkable thing about this species is the small number of body scales (15 only), whereas in all the other species the numbers are from 19 to 23. It is a very handsome and beautifully marked species.

DIEMENIA ANGUSTICEPS, n.sp.

Scales in 15 rows.

Anal plates, 2.

Abdominal plates, 201.

Sub-caudal plates, 83/83.

Total length, 2 feet $1\frac{1}{2}$ inch.

Tail, 6 inches.

Of slender form, the head narrow, elongate, and not narrowed behind into a neck; the posterior frontal shields large, their lateral margin in contact with the posterior nasal; the vertical and superciliary shields are long, the former scarcely wider at the apex than the base, and a little triangular at both ends; the posterior nasal is long and narrow, and with the anterior ocular takes the place of the loreal; there are six upper and lower

labials and two posterior oculars, all of normal form. The colour on the back is pale brownish-yellow, with a minute blackish spot on the apex of each scale; the under parts are of an unclouded yellowish-white; a brown stripe extends across the upper part of the rostral shield, along the nasal, and under the eye along the whole length of the labials; there are also one or two interrupted rather faint blackish streaks on the under side of the head. On the head shields a few pale brown spots are faintly visible. Eye large, pupil round.

DESCRIPTION OF A NEW *TRIPTERYGIUM* FROM
PORT JACKSON.

BY E. PIERSON RAMSAY, F.R.S.E., AND J. DOUGLAS OGILBY, F.L.S.

(*Notes from the Australian Museum*).

TRIPTERYGIUM STRIATICEPS, sp.nov.

D. 3/14/11. A. 1/19. V. 2. P. 15-16. C. 13. L.1. 36.
L. tr. 8.*

Length of the head four, of caudal fin five and a half to five and two-thirds, of pectoral fin three and three-fourths to four, height of the body beneath the origin of the second dorsal five and two-thirds to five and three-fourths in the total length. The eye is situated in the upper half of the head, and encroaches considerably on the occipital profile; its diameter is three and three-fifths in the length of the head, and equal to or slightly less than that of the snout, which is oblique, and a little convex, while the occiput is flat. The interorbital space is concave, and about four-ninths of the diameter of the eye. The cleft of the mouth is slightly oblique, the jaws equal, and the maxilla extends to the middle of the orbit. There is a short squarish multifid tentacle above the postero-superior angle of the eye; numerous fine spine-like tentacles on the upper and hinder margins of the eye. Upper jaw with a band of villiform teeth gradually narrowing from the front, and an outer row of greatly enlarged curved teeth; lower with several rows of curved teeth anteriorly, and a single lateral row. Vomer with an angular row of strong teeth. The first dorsal fin commences rather behind the middle of

* Counted along the oblique row between origin of third dorsal and the anal fin.

the opercle, and is lower than the two subsequent fins ; the second commences behind the base of the pectoral, and is disconnected with the first, while the third commences above the eighth anal ray, and is separated from the second by an interspace of three scales. The anal fin commences beneath the ninth ray of the second dorsal. The pectoral fin is long and pointed, about equal in length to the head, and reaching to the fifth anal ray. The caudal fin is slightly rounded. The lateral line is interrupted opposite the termination of the third dorsal fin. *Colors*—reddish-brown, with six or seven broad darker indistinct transverse bands, broader than the interspaces ; head with a dark brown light-edged band between the eye and the sub-opercle.

The two specimens, from which our description is taken, measure $1\frac{1}{2}$ and $1\frac{3}{4}$ inches respectively, and were obtained under stones between tide-marks at Tailor Bay, Port Jackson, by Mr. E. McIntosh. Register numbers, I. 1693-4.

NOTES AND EXHIBITS.

Dr. Hurst exhibited the egg of a Cuckoo taken out of the remains of a nest of *Malurus cyaneus*, at Newington, Parramatta River, on December 22nd, 1887, and in reference to it read the following note:—On the 4th December, in company with a friend, I visited Newington, and found, amongst the dead leaves of a branch lying on the ground, the nest of *Malurus cyaneus* containing several eggs of the *Malurus*, and an egg of *Chrysococcyx basalis*, all quite fresh. I left the nest intending to revisit it on the 18th December, but was unable to do so. However, on the 22nd December I revisited the spot, and found that the nest had been robbed by some one, and broken up. I picked up the bottom of the nest close by, handed it to my friend, who in tearing it to pieces found an egg in the wall of the nest, evidently laid there before the nest was finished, and covered up with fresh material by the owner of the nest. It had quite escaped the observation of those who had appropriated the other eggs in the nest. This egg corresponds with eggs which I have previously only found in, and seen taken from the nests of the white-shafted fantail (*Rhipidura albiscapa*), and which, from a local name of the *Rhipidura*, a friend of mine, Mr. Waterhouse, has been accustomed to call the eggs of the “Devil Bird Cuckoo.” The egg is of a thick ovoid form, and of a creamish-white colour marked with spots and blotches of brown sienna, which near the larger end form a well-defined zone. Here and there among the brown spots are blotches of a bluish-grey or slate colour, which appear as if they were underneath or in the substance of the shell. The blotches, both brown and slate colour, are larger in the zone than on the rest of the shell. The size of my egg is 0.7×0.53 inch. The measurements of three eggs taken by Mr. Waterhouse, of the High School, West Maitland, from nests of the white-shafted fantail on three separate occasions, are — (1) 0.7×0.58 , (2) 0.73×0.58 , (3) 0.7×0.55 inch. Dr. Ramsay kindly allowed me to measure an egg in

his collection: its measurements are 0.73×0.56 inch. The question now is, to what particular cuckoo are we to attribute this egg? The only cuckoo found in the neighbourhood of Sydney whose egg we do not know is *Cacomantis insperatus*, so that, as suggested by Dr. Ramsay and Mr. Masters, the egg is probably that of this species. I shall endeavour, should I find another egg like this, to hatch it out, and thus determine the species accurately; but I may say that the neighbourhood of Sydney is a bad place for hatching out experiments, as the young Australian has a penchant for dealing with all nests as he dealt with my *Malurus* nest.

Mr. Macleay exhibited the two snakes, *Dipsas ornata* and *Diemenia angusticeps*, described in his paper. Also, a collection of Fossils, chiefly from a supposed Tertiary formation named Pindan, occupying the greater portion of the coast country lying inland from King's Sound.

Mr. Deane exhibited a number of marine shells found in mud at a depth of over a hundred feet below the bed of the Hawkesbury River, at the site of the railway bridge. A discussion followed in which the President, Mr. Etheridge, and Mr. David took part.

Mr. Froggatt exhibited a fine collection of native weapons and implements obtained from the blacks of the Napier Range and Fitzroy River, N.W. Australia. It comprises spears with heads of quartz and glass, the latter manufactured from bottles obtained from the station; throwing-sticks; boomerangs of two kinds used by the coast and inland blacks respectively; stone-hatchets; fire-sticks; coolamans; baskets; shields used only by the coast tribes; a throwing waddy; hanks of twine made from the inner bark of the boabab tree; string made from opossum hair, and the spinning jenny for making it; a stick used for making warning noises during certain rites; wizard-stick used for bewitching enemies; feather bundles worn as chignons, in which spear heads are carried; and gum made from spinifex roots used for fixing the heads on spears, &c.

Mr. Ogilby exhibited the fish described in the paper by Dr. Ramsay and himself.

Mr. Etheridge exhibited the Fossils described in the two papers read by him.

Mr. S. C. Burnell exhibited a specimen of a rare moth (*Byleora* sp.), with its pupa case.

Mr. North exhibited the nests and eggs described in his paper.

Mr. Skuse exhibited specimens of the pupa and imago forms of *Orthoprosopa nigra*, Macq., a Dipterous insect belonging to the family Syrphidæ. The larvæ were obtained by Mr. Masters from the wet and decaying trunk of a dead grass-tree (*Xanthorrhoea arborea*) in the month of October, at Randwick, near Sydney. The perfect insects emerged within a fortnight, and the pupa form did not alter much from that of the larva. The body shortens, hardens, and becomes the puparium. As far as he could judge from dried specimens, the pupa seemed to possess seven pairs of pseudopodia, which appeared to be provided with minute recurved prehensile hooks. The body is $6\frac{1}{2}$ lines in length, ochraceous-brown, somewhat broader anteriorly; two small anterior horns; a short slender reddish-brown cylindrical tail projecting from the terminal segment; and a very small, somewhat reddish point appears on each side of the base of the tail.

Mr. Palmer exhibited a collection of native ornaments and manufactures, comprising plaited reed baskets, netted bags of various patterns, woven head-bands, a girdle of red fringed cord, shell ornaments, a neck ornament formed of the scrotal sacs of Dingoes strung on cord with shell pendants, and a carved letter-stick, all obtained from the blacks of Port Mackay and the Broadsound district, and sent to Sydney by Mr. Thomas Illidge. Also, fossil shells from near St. Lawrence, Queensland, and the nest of a species of wasp from Burwood.

Mr. T. W. E. David, B.A., F.G.S., exhibited for Mr. C. S. Wilkinson, F.G.S., F.L.S., &c., a fine specimen of a remarkable variety of intrusive basalt from Bulli Mountains near Bulli.

The rock is composed of large fragments of olivine; from one to four inches in diameter, and large crystals of augite from half inch to one and a half inches in diameter, set in a ground-mass of basalt. Both the fragments of olivine and the crystals of augite show evidence of having undergone much corrosion, especially the augite, which although occurring in well-formed crystals have had all their angles rounded off by fusion, so that many of them have the appearance of small oval pebbles. This fact is of great interest (1) as pointing to the fact that the olivine and augite have not crystallised out in the rock upon cooling subsequent to its intrusion, but must have crystallised and partly solidified at a considerable depth, and have been transported by the basalt to their present position in the course of its eruption; (2) as regards the temperature of the basalt it is evident that at some period or point of the eruption it was sufficiently high to fuse olivine and augite. The mode of occurrence of this remarkable rock is not yet known, but it is presumed by Mr. Wilkinson to occur as an intrusive boss.

Also, a specimen forwarded for determination to Mr. C. S. Wilkinson of the Department of Mines from the Canoblas, near Orange, which proves to be a very interesting variety of rock belonging to the Gabbro group. The rock is crystalline, granular in structure, and consists essentially of a diallage-like mineral, some variety of felspar (?), and a little magnetite. The precise species of this rock has not yet been determined, but it may be provisionally classed amongst the Gabbro group. This is, as far as Mr. David is aware, the first notice of the occurrence of this rock in New South Wales.

Mr. A. Sidney Olliff exhibited (1) *Palaeotoma styphelana*, Meyr., a lepidopterous insect (fam. Tortricidæ) which he had bred from the gall of a new species of Coccus belonging to the family Brachyscelidæ. The species appeared to be an inquiline and not the maker of the gall, as was supposed by the original describer of the species. The identity of the moth with *P. styphelana* was,

he said, beyond doubt, as it had been determined by Lord Walsingham; (2) A remarkable Coccus gall, probably representing a new genus of Brachyscelidæ, found on *Eucalyptus rostratus* at Parramatta, enclosing a female Coccus more than an inch in length.

Mr. Olliff added that he would be greatly obliged to any Members of the Society who would forward to him any galls which they might observe on Eucalypts, as he was at present working at their economy, with the view of preparing a memoir on the subject for publication in our Proceedings.

Mr. Fletcher exhibited the complete collection of plants obtained by Mr. Froggatt in the neighbourhood of Derby, N.W. Australia, comprising representatives of fifty natural orders, and about 180 species, the orders most largely represented being Amarantaceæ (10 species), Leguminosæ (about 20 species), Compositæ (9 species), and Gramineæ (about 18 species). The whole collection, which has been examined by Baron von Mueller, has been presented to the Society's herbarium by the Hon. W. Macleay.

Also, specimens of eighteen species of plants from the Cobarr district, collected and presented to the Society by Rev. J. Milne Curran, F.G.S., among which are a number recorded from N.S.W. for the first time by Baron von Mueller (*see Proc. Roy. Soc. of Victoria for 1887*), from specimens sent him by Mr. Curran.

WEDNESDAY, 30TH MAY, 1888.

The President, Professor W. J. Stephens, M.A., F.G.S., in the Chair.

Mr. C. A. Topp, M.A., F.L.S., of Melbourne, and Mr. R. Hunt, C.M.G., F.G.S., of the Sydney Mint were introduced as visitors.

Mr. Edward R. Deas Thomson was elected a Member of the Society.

The President announced that no Excursion will be held during the ensuing month.

DONATIONS.

"Reports of the first, second, and third Meetings of the Association of American Geologists and Naturalists, at Philadelphia in 1840 and 1841, and at Boston in 1842;" "Proceedings of the American Association for the Advancement of Science." Vols. I-XXXV. (1848-86); "Memoirs of the American Association," &c. No. I. (1875); "Nouvelles Archives du Muséum d'Histoire Naturelle." 2nde Série. Tome X., Fasc. 1 (1887); "Curtis's Botanical Magazine." 3rd Series. Vol. XLIII. (1887); "The Fishes of India." By Francis Day, F.L.S., F.Z.S. (Two vols). *From the Hon. William Macleay, F.L.S., &c.*

"Fresh-Water Sponges—A Monograph." By Edward Potts. *From the Author.*

"Mémoires de la Société des Naturalistes de la Nouvelle-Russie, Odessa." Tome XII, No. 2 (1888). *From the Society.*

‘Zoologischer Anzeiger.’ XI. Jahrg., Nos. 274-276 (1888).
From the Editor.

“Annalen des K. K. Naturhistorischen Hofmuseums, Wien.”
Band II., No. 4 (1887); Band III., No. 1 (1888). *From the Director.*

“Proceedings of the Asiatic Society of Bengal.” No. x. (Dec. 1887). No. i. (Jan. 1888); “Journal.” New Series. Vol. LVI., Part i., No. 3; Part ii., No. 3 (1887). *From the Society.*

“Records of the Geological Survey of India.” Vol. XXI., Part 1 (1888). *From the Director.*

“Abstract of Proceedings of the Zoological Society of London, 20th March, 1888.” *From the Society.*

“Bulletin of the Museum of Comparative Zoology at Harvard College, Cambridge, U.S.A.” Vol. XIII., No. 7 (1888). *From the Curator.*

“The American Naturalist.” Vol. XXII., No. 254 (Feb., 1888).
From the Editors.

“Department of Mines, Sydney,—(i) Mineral Products of New South Wales.” By Harrie Wood; (ii) “Notes on the Geology of N.S.W.” By C. S. Wilkinson, F.G.S., and (iii) “Description of the Seams of Coal worked in N.S.W.” By John Mackenzie, F.G.S. (In one Volume); “Annual Report for the year 1880.” *From the Department.*

“Bollettino dei Musei di Zoologia ed Anatomia comparata della R. Università di Torino.” Vol. II., Nos. 33 and 34 (1887). Vol. III., Nos. 35-38 (1888). *From the Museum.*

“Bulletin de la Société Zoologique de France.” Tome XII., Nos. 5 et 6 (1887); Tome XIII., No. 1 (1888). *From the Society.*

“Abhandlungen herausgegeben von der Senckenbergischen Naturforschenden Gesellschaft, Frankfurt a. M.” XV. Band, 1 Heft (1887). *From the Society.*

"The Transactions of the Entomological Society of London for the year 1887." Parts IV. and V. *From the Society.*

"Tables des Comptes Rendus des Séances de l'Académie des Sciences, Paris." Premier Semestre 1887. Tome CIV. *From the Academy.*

"Feuille des Jeunes Naturalistes." No. 210 (April, 1888) *From the Editor.*

"Abstract of Proceedings of the Royal Society of Tasmania, April 23rd, 1888." *From the Society.*

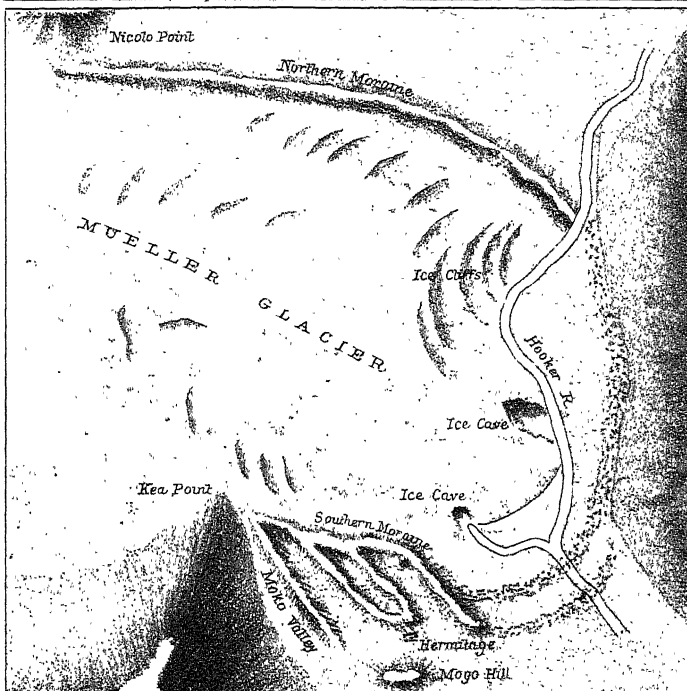
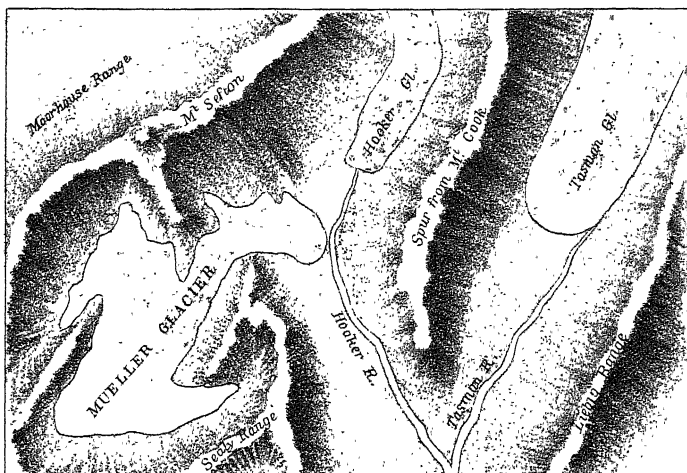
"Natuurkundig Tijdschrift voor Nederlandsch-Indië, uitgegeven door de Kon. Natuurk. Vereeniging in N.-I." Deel XLVII. (1887). *From the Society.*

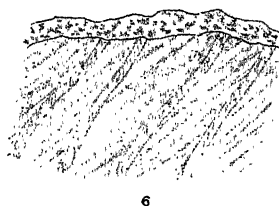
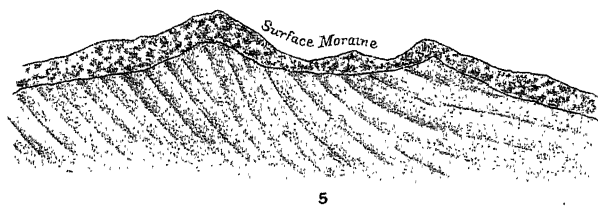
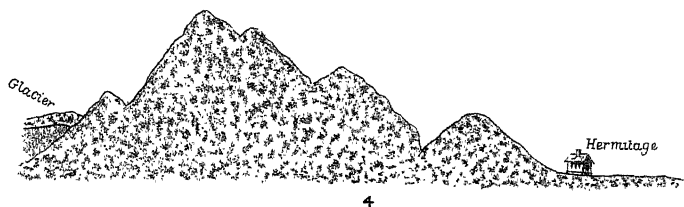
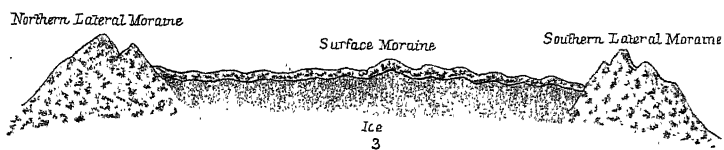
"Bulletin de la Société Impériale des Naturalistes de Moscou." Année 1888, No. 1; "Supplément (Meteorological)." *From the Society.*

"The Victorian Naturalist." Vol. V., No. 1 (May, 1888). *From the Field Naturalists' Club of Victoria.*

"The Journal of the Bombay Natural History Society." Vol. III., No. 1 (1888). *From the Society.*

"The Australasian Journal of Pharmacy." Vol. III., No. 29 (May, 1888). *From the Editor.*





PAPERS READ.

NOTES ON THE MUELLER GLACIER, NEW ZEALAND.

BY CAPTAIN F. W. HUTTON,
HON. MEM. LINN. SOC. OF NEW SOUTH WALES.

(Plates IX. and X.)

The first person who, so far as I am aware, recorded any observations on this district was Sir Julius von Haast, who visited it in March and April, 1862,* having with him Mr. A. D. Dobson and Mr. W. Young as topographical assistants.

In 1867 Mr. E. P. Sealy ascended for the first time the Mueller and Hooker Glaciers and made an excellent map of the district, on the scale of five miles to the inch, a part of which I have copied to illustrate this paper. It was in that and the three following years that Mr. Sealy took the beautiful photographs, some of which illustrate Dr. von Haast's "Geology of Canterbury and Westland."

In 1868 Dr. von Haast finished his topographical map of Canterbury, on a scale of four miles to an inch, the original of which is preserved in the Canterbury Museum. In it the Mueller Glacier is not shown so correctly as in Mr. Sealy's map.

In 1870 Dr. von Haast again visited the Mount Cook district for the Geological Survey of New Zealand, and he gave a general account of the geology of the country and a section through Mount Sefton and Sealy Peak in the "Reports of Geological Explorations," 1870-1, p. 19.

* Notes on the Geology of the Province of Canterbury. Canterbury "Gov. Gazette," Vol. IX., No. 18, October 24th, 1862.

In 1879 Dr. von Haast published his "Report on the Geology of Canterbury and Westland," in which he relates his explorations in the Southern Alps, including the district under discussion (l.c. p. 32).

In 1882 the Rev. W. S. Green made the ascent of Mount Cook, and has recorded his experiences in papers in the "Proc. Royal Irish Academy," 2nd Series, Vol. III., Dec. 1882; in "Proc. Royal Geographical Soc.," Feb., 1884; in the "Alpine Journal," and in "High Alps of New Zealand." In the following year Dr. R. von Lendenfeld went up the Tasman Glacier and ascended Hochstetter Dome. His full account is published in Dr. A. Petermann's "Mittheilungen aus J. Perthes' Geograph. Anstalt," *Ergänzungsband XVI.*, 1883-4, No. 75; and a short account in the "New Zealand Journal of Science," Vol. I., pp. 504 and 558.

Messrs. Burton Brothers, of Dunedin, took photographs of the Mueller and Hooker Glaciers in 1875. Mr. Coxhead, also of Dunedin, photographed them in 1886; and Mr. Wheeler, of Christchurch, in 1888.

Last March I spent ten days at the Hermitage, and explored the lower part of the Mueller Glacier. Finding from Mr. Huddleston that several important changes have taken place during the three years that he has lived there, I have thought that it would be useful to record these changes, and with this view I have incorporated some observations of my own with them. The dimensions of the glacier are taken from Mr. Sealy's map.

GEOLOGICAL STRUCTURE OF THE DISTRICT.

The rocks forming the Sealy and Moorhouse Ranges, as well as those on the southern spur of Mount Cook, are chiefly greywackes and black slates, the former being often penetrated by white quartz veins; but in addition to these fragments of red or chocolate-coloured slates are found occasionally among the *debris* on the glacier. The greywackes are generally grey, but sometimes

black. I saw none of the green greywackes which are so common in some parts of New Zealand. In the black slates annelid tubes are not rare. Sir Julius von Haast found them on the Tasman Glacier among *débris* which had come down to the Hochstetter Glacier, and I found them on the Mueller Glacier. These tubes occasionally attain a length of 5 inches, with a breadth of a third of an inch. They are nearly straight, smooth on the outside, and taper very gradually. The rocks therefore belong to the Matai Series of the Geological Survey. I saw no trace of plant remains in any of them, but Dr. von Haast mentions "Fucoid Shales" on the southern spur of Mount Cook, near the junction of the Hooker and Tasman Rivers (l.c., p. 21). Neither Dr. von Haast nor myself saw any eruptive rocks, but Mr. Green mentions having found on the Tasman Glacier "a kind of volcanic breccia, which, according to Professor V. Ball, consists of fragments of pyroxene and felspar, the latter much decomposed, and some free silica."* A block of marble, mottled but generally pinkish in colour, lies on the centre of the lower part of the Mueller Glacier; and near the present outlet there is a single large fragment of conglomerate which contains pebbles of sandstone, quartz, greywacke, and (I think) some fragments of a chlorite schist presently to be mentioned.

Along the southern side of the lower portion of the Mueller Glacier blocks of phyllite and quartz-schist are common, and occasionally there are fragments of a green subschistose chloritic rock, with grains of Ripidolite scattered through it or collected in foliæ; but none of these fragments are found on the northern side. Black-birch Creek—a tributary of the Hooker from the Sealy Range—also brings down similar fragments of phyllite, quartz-schist, and the chloritic rock, as well as greywackes and black and red slates: so that a patch of these schistose rocks must exist near the north end of the Sealy Range. Sir J. von Haast noticed these schists and shows them in his section, already

* "Proc. R. Irish Academy," Dec. 9, 1882, p. 651.

mentioned, as forming Sealy Peak and underlying the greywackes and slates unconformably. In his report he says that the two formations appear to be unconformable, but he saw no line of junction, and bases his opinion on a difference in the strike of the two; this difference however, according to his section, is slight. I also was unable to examine a junction between the two sets of rocks (although such will easily be found in the Sealy Range), but on the centre of the Mueller Glacier I found a large block, some 8 feet cube, which was composed partly of greywacke and partly of phyllite, the one passing insensibly into the other. The phyllite was largely charged with quartz foliæ, some of which passed as veins into the unaltered greywacke. From this I conclude that the phyllites and quartz schists belong to the same formation as the greywackes and slates, and have been locally produced by pressure metamorphism; at the same time it must be remembered that these schists occupy an anticlinal—as will presently be shewn—and are therefore just in the position where an older formation might be expected to occur.

Sir J. von Haast examined the western slopes of the Moorhouse Range in 1868 and found it to consist of true foliated schists—mica and chlorite schists resting on gneiss—but none of these rocks are found on the eastern side. Mr. Green found the very topmost rock of Mount Cook, “just appearing below the cap of ice which forms the summit,” to be quartzite; which he thinks belongs to the metamorphic formation underlying the Maitai Series*

A lode of iron pyrites in quartz and quartz-schist runs along the north end of the Sealy Range opposite the Hermitage under Huddleston Peak. It appears to be parallel to the bedding. By its decomposition it has stained many of the sandstones below it of a rust-red colour.

In the gorge of Black-birch Creek, at the north-east end of the Sealy Range, the dip is 75° E.S.E., and at Kea Point, at the north-

* Proc. R. Geographical Soc. of London, Feb. 1884, p. 8.

west end of the range, it is about 40° W.N.W., so that an anticlinal axis runs through the Sealy Range under Huddleston Peak. In the Moorehouse Range, near Nicolo Point, the dip is 30° W.N.W., so that the rocks of the eastern face of that range are younger than those of Sealy Range. In the southern spur of Mount Cook the dip appears to be 30° N.E. and, according to Mr. Green, all the lower spurs east of Mount Cook have an easterly dip. The rocks forming the peak of Mount Cook, however, dip 30° to the westward (l.c. p. 8), so that the anticlinal axis of the Sealy Range appears to run up the lower part of the Hooker Glacier and passes to the east of Mount Cook, between the peak and Hochstetter Ridge.

The mountains rise abruptly out of the flat river valleys, and during heavy rains large quantities of angular shingle are brought down the gullies and form "talus fans" like those of the Upper Indus, so well described by Mr. Drew.* These fans on the sides of the mountains rest at angles of 30° to 35° , but where they spread out in the valley they flatten to 15° .

The rocks forming the mountains show no signs of ice having ever occupied the Lower Hooker Valley, and if it had not been for the old lateral moraines, which are found high up the hills on either side of the Tasman, and the old terminal moraine which extends some distance below Lake Pukaki, we should never have surmised that these glaciers had had such an enormous extension at some former period.

THE MUELLER GLACIER.

The main snowfield of the Mueller Glacier lies between the Sealy and Moorhouse Ranges, and, with the upper part of the glacier, covers an area of about ten or twelve square miles. This forms a kind of basin from which the glacier escapes by an opening at the north-west corner rather less than a mile broad,

* "Quar. Jour. Geol. Soc. of London," Vol. XXIX. (1873), p. 444.

and forming the middle part of the glacier. On emerging from this opening the glacier turns to the west, almost at a right angle to its former direction, and receives a considerable addition from a glacier descending in an easterly direction from the south eastern slopes of Mount Sefton. It now expands until it reaches a breadth of a mile and a half, and then decreases again to about a mile at its terminal face. The length of the upper glacier and snowfield is about five miles, the middle portion one and a half miles, and the lower portion two and a half miles, thus giving a total length of nine miles.

Several small feeders come in on the north side of the lower portion from Mount Sefton, but these are generally glaciers of the second order and pay their contributions in the form of ice avalanches, which in the summer melt before they can be incorporated with the main glacier.

In his report of 1862, Sir J. von Haast gives the height of the terminal face above the sea as 2851 feet, but in his "Geology of Canterbury and Westland" he puts it at 2578 feet. No mention is made of the discrepancy, and I cannot say which of the two is nearer the truth.

The whole of the lower portion of the glacier and most of the middle portion, is covered with angular detritus deposited on the glacier as shingle slips from the surrounding precipitous mountains; lateral and medial moraines being confluent into a continuous mass covering the whole surface of the glacier, and which I will distinguish as the "surface moraine." The only glacier in the Swiss Alps which approaches the Mueller in the quantity of *debris* on the surface is the Glacier de Miage, on the south side of Mont Blanc, of which Prof. J. D. Forbes says "nearly the whole surface is covered with moraine."*

This morainic matter is not smooth on the surface but broken-up into ridges and hillocks by the melting of the ice below. As

*Travels through the Alps of Savoy, 2nd ed., p. 197.

the ice is protected from the direct rays of the sun by this thick surface moraine the ablation of the glacier is caused chiefly by rain. During my visit heavy rain, with a north-west wind, fell continuously for two days. This rain had, during the second day, a temperature of 50° F., while that of the air at 9 a.m. was 56° F. As soon as the rain was over I visited the outlet of the glacier and found that the water, which was rushing out with great force, had a temperature of $32\frac{1}{2}^{\circ}$ F. It follows therefore that the rain had lost $14\frac{1}{2}^{\circ}$ F. of temperature, which must have been mainly expended in melting ice. Rain from the south-east varied in temperature from 45° F. to 48° F.

One of the most remarkable features of the Mueller Glacier is the two large lateral moraines which cross transversely the Hooker Valley, and between which the glacier flows far out from the mountain valley without any increase in breadth. In this respect it resembles the glacier of La Brenva, south of Mont Blanc, which crosses the Allée Blanche, and the glacier of Allalein, which crosses, in the same way, the valley of the Saas, north of Monte Rosa. Of these lateral moraines the northern one is comparatively simple, being composed only of two moraines, a smaller one inside a larger; but the southern lateral moraine is much more complicated. These lateral moraines are due to the immense quantity of *débris* on the lower part of the glacier, which is constantly being shed off at the sides. In this way the glacier, when it emerges from the mountain valley, builds up a wall on each side, and between these walls the glacier advances over the plain, instead of spreading out in a fan, as it must have done if the surface of the ice had been clean.

The northern lateral moraine starts from a small unnamed tributary glacier a little to the west of Nicolo Point, and continues for about a mile and a half, gradually curving down the valley from E.S.E. to S.E. It is, as I have said, double. The outer portion is, where highest, about 400 feet above the upper Hooker Valley, and is covered with alpine vegetation. Inside this and a hundred feet lower, is another moraine, more recent and destitute

of vegetation, which follows the older one all round. The surface of the ice at present may be about 50 to 100 feet lower than this second moraine.

The southern lateral moraine is about half a mile long, and forms what is known as White-horse Hill, at the base of which the Hermitage stands. The outer portion is covered with bush and its form is not well seen except by getting a bird's-eye view from one of the talus-fans of Huddleston's Peak. It is then seen to consist of the remains of four, more or less concentric, lateral moraines rising successively in altitude from the outermost and oldest, which is perhaps 200 feet high, to the innermost which corresponds to the older northern moraine and attains a height of 500 feet above the lower Hooker Valley at the Hermitage (see fig. 4). All these four moraines are covered with vegetation, but inside the highest is a newer and almost bare moraine at a much lower level and corresponding to the inner and newer northern moraine. I was informed by Mr. Nicolo Badove—who owned and lived at Birch-hill Station several years before Dr. Haast visited the district in 1862—that when he first came the glacier was up to this newer moraine. It is now perhaps 50 to 100 feet below it.

The outer and older moraines of White-horse Hill do not reach up to the Sealy Range, but are separated from it by two small valleys with a still older lateral moraine between them, running S.E. and N.W., the valley between the moraine and the mountains being known as Moko Valley. This oldest moraine forms part of a system of which Mogo Hill, presently to be mentioned, was the terminal moraine.

The Mueller Glacier, at present, forms no terminal moraine, for the Hooker River carries all the *débris* away. But lower down in the valley, bending round in the usual way, may be seen two old terminal moraines, about 150 yards apart, and corresponding with, or rather passing into, the two inner lateral moraines. These terminal moraines are not large nor high. Still lower down the valley is Mogo Hill, rising about 100 feet above the plain and

marking the site of a former terminal moraine, which I think must have been continuous with the oldest lateral moraine that forms the eastern side of Moko Valley. The small hill at the Hermitage stables is the remains of another portion of this system, but of a slightly later date, for its direction shows that it is also part of a terminal moraine. On none of the moraines, either modern or ancient, did I see any striated or glaciated stones.

These old moraines show a period of increase in the glacier, followed by one of decrease which is now going on. But the period of increase could not have been continuous, for the four moraines of White-horse Hill show periods of decrease alternating with those of increase. But at each successive period of increase the ice attained a greater thickness than it had at its former maximum. How far the alternating decrease went we have no means of ascertaining. Possibly the glacier at these times may have had no greater dimensions than it has at present; and it is quite possible that a period of increase might again set in, and the glacier might out-top the highest of the lateral moraines, completely obliterating the smaller inside moraine which was being formed in 1860.

The terminal face of the glacier is rather less than a mile in breadth, and owing to the destructive action of the Hooker River, which passes along it, is constantly changing. At the present time the northern third of the face is occupied by a magnificent series of ice cliffs from 100 to 150 feet high, one behind the other, while the outlet is close to the southern end of the face.

At the outlet there is a small cave from which a small stream flows over the ice, but the main body of water issues as a spring some 40 feet below the ice cave. After two days' rain the spring was a wonderful sight as it threw up a vertical column of water 5 or 6 feet high, and 12 or 15 feet broad, like a fountain. This, I think, shows that the opening of the main outlet is vertical; and, consequently, that the ice descends below the level of the shingle of the Hooker Valley.

CHANGES THAT HAVE TAKEN PLACE IN THE TERMINAL FACE.

Twenty-five years ago the Mueller Glacier passed over the Hooker River and abutted against the southern spur of Mount Cook, being separated from the rocks only by a moraine. This was its condition when visited by Sir J. Haast in 1862, and by Mr. Sealy in 1867, as shown in the photograph accompanying Dr. Haast's report on the Geology of Canterbury and Westland. In this report he says that the Hooker River found its way below the Mueller Glacier some 150 yards from the spur of Mount Cook, and issued with the outlet of the latter from a magnificent ice vault. "For more than 100 yards below it the ice forms perpendicular walls on both sides about 100 feet high, often washed out into bold forms resembling turrets, minarets, or gigantic statues, and sometimes crowned with enormous erratic blocks" (l.c. p. 33). At this time sheep belonging to the Birch-hill Station, were annually driven over the glacier on to the slopes of Mount Cook. But the Hooker river, flowing under the ice, gradually melted it and the end of the glacier gave way. A heavy flood, which occurred in 1868, brought down large quantities of ice, and the last ice-bridge broke down in 1878, since when it has not been possible to drive sheep on to Mount Cook.

At the end of 1884, when Mr. Huddleston arrived and built the Hermitage, the Hooker River skirted the whole breadth of the glacier, but in March 1885, it again cut its way under the northern corner of the glacier. It entered by an ice-cave just below the north lateral moraine of the Mueller, and came out again by another cave about two-thirds of the way across the face. During 1887, this long ice cavern was constantly falling in, but the grand collapse was in Jan. 1888, when the whole of the ice over the Hooker disappeared, and the river once more skirted the terminal face of the glacier. The ice-cave out of which the Hooker flowed in 1886 still exists. At present the terminal face of the glacier is 250 to 300 yards from the moraine on Mount Cook spur, against which it abutted in 1867.

One effect of this collapse of the terminal face was to form crevasses for two miles up the glacier, many parts being now impassable which were easily traversed formerly.

MOVEMENT OF THE GLACIER; AND CREVASSES.

No precise measurements of the rate of motion of the ice have been attempted as yet, but Mr. Huddleston informs me that a large and well-marked rock on the lower part of the glacier, rather to the south of the middle line, has moved about 250 yards in the three and a half years he has known it: that is at the rate of $214\frac{1}{4}$ feet in a year. On the northern side of the middle line of the lower part of the glacier there is a very remarkable ice-cone 12 or 15 feet high, which appeared to Mr. Huddleston to move very slowly until about a year ago, but during the last year it has travelled about 300 feet.

The marginal crevasses between Kea Point and Nicolo Point are generally normal, forming portions of curves convex up the valley; and the same may be said of the crevasses all along the northern lateral moraine as far as the terminal ice cliffs. Along the southern side of the lower part of the glacier there are no crevasses, except near Kea Point; and I am informed by Mr. Huddleston that in 1886 there were no crevasses on the northern side, the present ones having been formed since the washing away of the terminal face of the glacier by the Hooker River.

STRUCTURE OF THE ICE.

All through the lower portion of the glacier the ribboned or veined structure of the ice is distinctly seen in the crevasses, the white ice containing very large air bubbles. At the foot of the small tributary glacier from Mount Sefton, which joins the Mueller a little west of Nicolo Point, the ice is quite clear, and the laminations are seen on the surface to run transverse to the small glacier; that is, in a N.E. and S.W. direction. Lower

down on the main glacier the direction varies from E.S.E. to S.E., which is the direction in which the glacier is flowing. In one case, on the north side of the lower glacier, I found a dip of 65° S.W., but my observations were not sufficiently numerous to justify any generalisation on the subject. The blue bands are irregular, and vary from $\frac{1}{2}$ to 1 inch in thickness, but perhaps some may be thicker. They do not stand out above the white ice, but both kinds melt with equal facility.

At the terminal face there are two systems of laminations crossing one another at angles of from 15° to 20° (see fig. 6). In one system the blue bands are small, from $\frac{1}{2}$ to 1 inch in thickness, and irregular sometimes anastomosing, and divided by bands of white ice from 1 to $1\frac{1}{2}$ inches in thickness. This system resembles the laminated structure higher up the glacier. The second system is formed by larger blue bands, from 3 to 6 inches in thickness and from 2 to 6 or more feet apart; but they are only occasionally developed. The strike of both is the same and varies from E. to S.E., that is parallel to the length of the glacier, but the smaller system forms a well-marked synclinal curve in the terminal ice cliffs (see fig. 5). The ice here contains, in places, small nests of mud and numerous angular stones scattered irregularly through the ice, and these always have their long axes parallel to the smaller systems of laminations. These stones have no doubt entered the ice from the lateral moraine or through the numerous moulins that are found higher up, or have fallen down crevasses. At first they must have been irregularly oriented, but the movements of the ice have scattered them and their present parallelism to the smaller system of laminations is a decisive proof that that system is due to pressure at right angles to the structure, and furnishes another analogy between the veined structure of glacier ice and the slaty cleavage of rocks. That the ice does not split like a rock is no doubt due to regelation. At first sight it might be thought that the flowing of the ice down the valley would by itself be sufficient to place the rock fragments parallel to its line of flow; but a little consideration will show that, in order to do this, the ice must flow *past* the stones, that is must move faster

than they do, which cannot be the case in so slow a movement as glacier flow. Nothing but lateral pressure squeezing the ice out all round the stones is, I think, capable of explaining their parallelism.

The origin of the larger system is not so obvious. As the clear ice bands of both systems blend when they meet it is not possible to make out by mere inspection which is the older of the two. If the coarser system is the older, I think I should have noticed it higher up the glacier, which I did not do. If, on the other hand, the coarser system is the newer, it is difficult to see why the rock fragments are not parallel to it. Possibly it may have some other origin than pressure.

Mr. Guyot says that on the Gries glacier, in Switzerland, the surface is "covered with regular furrows, from one to two inches wide, hollowed out in a half snowy mass, and separated by protruding plates of harder and more transparent ice."* Professor J. D. Forbes makes a somewhat similar statement. He says "These bands or veins were conspicuously distinguished (on the glacier of the Aar and others) by two characters—(1) Difference of hardness, (2) Difference of colour. The former distinction causes the harder (which are also the bluer) veins to stand up in ridges, as the ice melts by the action of the sun or rain, and allows the comminuted sand from the moraines to lodge in the intervening linear hollows, which led, as we have seen, some persons to suppose that the heat of the sun, acting upon the sand, *caused* the hollows in which it lay. This peculiarity is admirably seen on many parts of the Mer de Glace; and nowhere better than upon the common route from the Montanvert to the Jardin, where it passes by the foot of the Aiguille des Charmoz, between the *Angle* and Trélaporte. Here the whole surface seems striated with fine lines; and where groups of the harder bands occur, there are projecting ridges, with grooves between, continuous for very many fathoms along the ice, resembling the cart ruts of a much

* Quoted by Tyndall in *Forms of Water*, p. 184.

travelled road, when covered with stiff mud, which was the accurate comparison of an English traveller, whose attention was directed to them for the first time. This appearance is most conspicuous after rain.”*

I observed nothing of this on the Mueller Glacier, either on slopes exposed to the sun or on those turned away from it. Both kinds of ice melt here with about equal rapidity. The grooving of the ice by runlets of water is certainly parallel to the structure when it is vertical or highly inclined, but the grooves are formed in several layers of both kinds of ice, and it seemed to me that the compact ice melted rather more rapidly than the vesicular ice. When the ice structure shows in the cliffs as horizontal or slightly inclined, the grooves run across the laminations. I cannot suggest any cause for this difference between the ice of the Mueller Glacier and that of the Swiss glaciers.

EXPLANATION OF PLATES.

- Fig. 1. Map of the glacier district (scale five miles to an inch).
- Fig. 2. Map of the Mueller Glacier (scale one mile to two inches).
- Fig. 3. Section through Mueller Glacier.
- Fig. 4. Section through White-horse Hill or the Southern Moraine.
- Fig. 5. Figure showing structure of ice at terminal ice-cliffs.
- Fig. 6. Figure showing double structure in ice.

* Travels through the Alps of Savoy, 2nd ed., p. 159.

THE INSECTS OF KING'S SOUND AND ITS VICINITY.

BY WILLIAM MACLEAY, F.L.S., &c.

I have on previous occasions announced to the Society the receipt of collections made by Mr. Froggatt in the King's Sound district of north-west Australia, and now I am enabled to report the return of Mr. Froggatt himself, with very considerable additions to his already large stock of Coleoptera. The result of his twelve months collecting is now before me, numbering about 1000 species, very many of them new.

I propose in this and subsequent Papers to give as complete a list as I can of all the species in the collection, believing that I shall thus be best enabled to give Entomologists an idea of the value and variety of the Fauna of that part of Australia.

Short descriptions are given of the new species, and the references to those previously described are confined to the numbers attached to each in Mr. Masters' Catalogue of the Coleoptera of Australia published in our Proceedings.*

Family CICINDELIDÆ.

1. TETRACHA HOPEI, Castln.

Mast. Cat. Col. Sp. 8.

2. TETRACHA AUSTRALASIÆ, Hope.

Mast. Cat. Col. Sp. 3.

3. CICINDELA CIRCUMCINCTA, Casteln.

Mast. Cat. Col. Sp. 13.

4. CICINDELA FROGGATTI, Macl.

Proc. Linn. Soc. N. S. Wales, Ser. 2, Vol. II. p. 213.

* Proc. Linn. Soc. N.S. Wales, Vol. X., 1st Series and Vols. I. and II. of 2nd Series.

5. *CICINDELA ALBOLINEATA*, n.sp.

Coppery-bronze, densely punctate. Head scarcely concave between the eyes, antennæ nearly the length of the entire insect, slender, the joints from the fourth slightly pubescent, the labrum white, more than twice as wide as the length, nearly truncate, and with a few punctures in the middle. Thorax as long as broad, slightly constricted near the base and apex, slightly rounded on the sides and feebly canaliculate in the middle. Elytra much broader than the thorax and thrice the length, widening a little behind the shoulders and broadly rounded at the apex, with a broad lateral margin, a sutural vitta on the apical half, and an intermediate interrupted irregular vitta, white. The under surface is of a brilliant copper colour, the thighs are albo-pilose at the base, and of a reddish hue near the apex; the apex of the tibiæ and the tarsi are slightly pubescent.

Length, 5 lines.

This and the next following species belong to the *C. upsilon* group, characterized by the elytra more or less white, and by their constantly frequenting sandy sea beaches.

6. *CICINDELA TRIVITTATA*, n.sp.

Of a rather redder bronze than *C. albolineata*, and not quite so densely punctate. The head is rather more concave between the eyes, the labrum more transverse, quite truncate and without punctures. The thorax is a little broader than long, very little rounded on the sides, constricted near the apex, and deeply transversely marked near the base, with the posterior angles protruding strongly in a lateral direction. The elytra are about four times the length of the thorax and not much wider, and are rounded at the apex, with a broad sutural vitta a narrow margin excepted, a broader lateral margin, a broad twice interrupted central vitta, the base and apex, white. The abdomen is dark coppery red, each segment with a steel-blue base, the apical

segment reddish; the legs are bright metallic green, excepting the thighs, which are albo-pubescent at the base and reddish at the apex.

Length, $4\frac{3}{4}$ lines.

7. *CICINDELA CRASSICORNIS*, n.sp.

Head and thorax of a dark coppery lustre, the elytra dull cyaneous, beneath bright cyaneous. The head is finely and densely striolate and rather deeply impressed between the eyes; the antennæ are little more than half the length of the body, of a reddish-brown colour, and thickened and compressed from the fifth joint; the labrum is white, broad, largely rounded in front, nearly as long as broad, and serrated or finely toothed on the anterior edge. The thorax is nearly square, constricted in front and behind, slightly rounded in the middle, canaliculate in the middle and very minutely striolate. Elytra broader than the thorax and more than thrice the length, broadly rounded at the apex, of an opaque bluish-black colour, with a small spot on the humeral angle, a larger one behind the middle and near the sides, and a still larger one at the posterior angles, white; a line of about eight punctures showing a coppery reflection extends along the length of each elytron not far from the suture, and a few similar punctures are placed in a short depression near each humeral angle. Under surface brilliant blue; legs reddish, very sparingly pilose, a patch of long white pile on the sides of the metathorax.

Length, 4 lines.

8. *CICINDELA OBLONGICOLLIS*, n.sp.

Brassy-black and of elongate form. Head very finely striolate, concave between the eyes; labrum black with whitish edge in front, as long as broad, rounded in front, and toothed. Thorax narrow, much longer than wide, constricted near the apex and base, and not rounded on the sides. Elytra broader than the thorax and nearly three times the length, rounded at the apex,

densely and rather coarsely punctate. Under surface brilliant blue, legs and abdomen green, sparingly pilose.

Length, 3 lines.

This and the following species, both very minute insects, were taken upwards of 100 miles inland from King's Sound, in the neighbourhood of the Barrier Range.

9. *CICINDELA TENUICOLLIS*, n.sp.

Bright golden red, rather coarsely punctate. Head concave and rather narrow between the eyes, labrum rather broader than long, the apex white, rounded and toothed. Thorax as in *C. oblongicollis*, but more rounded on the sides. Elytra broader than the thorax and about three times the length, rounded at the apex with a minute sutural spine, a minute spot near each lateral margin a little behind the middle and the posterior angles, white. Under surface brilliant bluish-green, legs a little purplish, very slightly pilose.

Length, $2\frac{1}{2}$ lines.

Family CARABIDÆ.

Sub-Family ODACANTHIDES.

10. *CASNONIA ANGUSTICOLLIS*, n.sp.

Of elongate form, black, nitid. Head long, widest at the eyes, triangularly prolonged behind into a long narrow neck, the forehead bisulcate and corrugated, the occiput very smooth and slightly convex, the third joint of the antennæ as long as the first, and much longer than the others. Thorax more than twice as long as broad, narrowed at the apex, slightly rounded at the sides, widened a little behind the middle, moderately convex, punctate and grooved on the sides, smooth and lightly canaliculate on the back, and transversely striate at the base. Elytra elongate, but much wider than the thorax, deeply punctate-striate on the basal half, very sparingly punctate on the apical portion, with an oval yellow or reddish spot near the apex of each elytron, and a narrow lateral

margin of the same colour. Legs brown, with the base of the thighs and the middle of the tibiæ yellow.

Length, 4 lines.

This may probably be identical with *Casnonia Clarensii* of Castelnau, a species from the Clarence River, but Castelnau makes no mention of the third joint of the antennæ being much longer than the following ones, a peculiarity which should properly exclude it from the genus altogether.

11. CASNONIA GLOBULICOLLIS, n.sp.

Of less elongate form than *C. angusticollis*, the head bluish-black, nitid, smooth and convex, rounded behind abruptly into a very narrow neck, and with the frontal impressions deep but short. The whole body, head included, is clothed rather thickly with long soft erect hair. The thorax is red, nitid, of globular form, much narrowed in front and behind, about as wide as the head at the eyes, and scarcely longer than wide. Elytra broadly ovate, nitid, rather thinly punctate in rows, only about twice the length of the thorax; in colour purplish-black, with a broad fascia from behind the shoulders to the suture, where it is prolonged backward, and a spot near the apex, of a deep red colour. The base of the thighs and the greater part of the tibiæ are pale yellow, the rest of the legs brown. The third joint of the antennæ is not longer than the following ones.

Length, 3 lines.

This species might be taken for an *Opheonia*, but the fourth joint of the tarsi is entire.

12. EUDALIA WATERHOUSEI, Casteln.

Mast. Cat. Sp. 62.

Castelnau described this species from a specimen from Arnheim's Land, given to him by Mr. Waterhouse of South Australia. The genus, which is widely distributed throughout Australia, is classed by Castelnau with the Sub-family *Otenodactylides*, because the elytra are not truncated; it is notwithstanding, however, not far removed from the *Odacanthides*.

13. EUDALIA FROGGATTI, n.sp.

Of more elongate form than *E. Waterhousei*, and of an opaque black colour. Head a little nitid, with deep frontal impression; the antennæ long, slender, reddish-brown, the joints, after the second, elongate; the neck short and distinct. Thorax twice as long as wide, narrower than the head, very slightly widened and rounded on the sides, finely, densely and rugosely punctate, very finely canaliculate in the centre. Elytra more than twice the width of the thorax and nearly three times the length, striate-punctate and minutely punctate on the interstices, and acutely sinuate at the apex. Thighs brown, the coxæ, tibiæ and tarsi reddish.

Length, 4 lines.

14. EUDALIA SUBLÆVIS, n.sp.

Black, nitid. Head short, impressed and corrugated between the eyes, narrowed behind the eyes into a short neck, the antennæ reaching slightly beyond the thorax, and with the palpi of a brownish-red colour. Thorax elongate, cordiform, narrower than the head at the eyes, twice as long as wide, very nitid, and deeply canaliculate in the middle. Elytra much wider than the thorax and a little more than twice the length, punctate-striate,—the punctures small, the interstices flat and without punctures—not amplified behind, and sub-truncate at the apex. Legs entirely of a reddish-yellow.

Length, 3 lines.

Sub-Family GALERITIDES.

15. ZUPHIUM PINDAN, n.sp.

Of the size and general appearance of *Zuphium Australe*, Chaudoir. Black, nitid. Head broadest, and broadly rounded, behind the eyes, smooth, very slightly impressed in front, the labrum piceous, the antennæ and palpi brownish-red. Neck distinct, narrow, short. Thorax flat, scarcely wider than the head in front, about $1\frac{1}{2}$ times longer than broad, truncate at the

apex, very slightly amplified on the sides, narrowed behind the middle, with the posterior angles acute and recurved. There is a very minute puncturation on the upper surface, the median line is very slightly marked, and the grooves on each side of the base are broadly and deeply impressed, but do not extend forward more than one-third of the length. The elytra are broader than the thorax and a little over twice the length, flat, striate, subnitid, rounded at the humeral angles, and truncate at the apex. The under surface and legs are of a pitchy brown.

Length, 4 lines.

16. *ZUPHIUM FITZROYENSE*, n.sp.

This species is very like *Z. Pindan*, as indeed are all the species of the genus known to me; it differs in being almost entirely of a reddish colour, excepting the elytra, which are of an opaque black; the head is more impressed in front, the thorax is more cordiform, legs flat, and less acute and recurved at the posterior angles. The elytra are densely and very minutely punctate, and the striæ are somewhat faint. The antennæ and legs are longer and entirely red.

Length, $4\frac{1}{2}$ lines.

17. *POLYSTICHUS AUSTRALIS*, Macleay.

Mast. Cat. Col. Sp. 67.

This is altogether a smaller insect than those from the East Coast, and may be another species, but I cannot make out any good specific difference.

18. *ZUPHIOSOMA FULVUM*, Casteln.

Mast. Cat. Col. Sp. 73.

Sub-family HELLUONIDES.

19. *GIGADEMA FROGGATTI*, n.sp.

Very like *G. sulcatum*, Macleay; black, subnitid, labrum smooth, excepting a few punctures on the apex, a little broader than the

length, and very slightly rounded in front. Head not swollen behind the eyes, occiput coarsely punctate, a transverse ridge separating it from the front, which is almost smooth in the middle and impressed and punctate on each side; the clypeus is large, thinly punctate, and foveate in the middle. Thorax shorter than the width, very rounded on the sides and narrowed behind, rather convex in the middle; the basal side impressions well marked, the transverse apical impression almost rectangular, the whole coarsely but not very densely punctate. Elytra 8-grooved with two rows of strong punctures in each, the interstitial ridges very narrow.

Length, 8 lines.

20. *HELLUOSOMA LONGICOLLE*, n.sp.

Black, nitid, clothed with short yellowish pubescence. Head smooth in the middle, and a little depressed in the centre of the forehead, the rest of the head coarsely punctate; the clypeus much broader than long, the labrum rather longer than broad, rounded in front with an impression near each apical angle. Thorax cordiform, longer than broad, and roughly punctate with two or three imperfect longitudinal ridges on the disk. Elytra a little broader than the thorax, and about two and a half times the length, 8-striate, with the interstices moderately flat, and densely and minutely punctate.

Length, 9 lines.

21. *HELLUOSOMA VIRIDIPENNE*, MacI.

Proc. Linn. Soc. N.S. Wales, 1887 (2), Vol. II., p. 216.

I find the metallic colouring of the elytra of this species varies from green to blue.

22. *HELLUOSOMA PARVULUM*, MacI.

Ænigma parvulum, MacI., Mast. Cat. Col. Sp. 76.

Sub-Family BRACHINIDES.

23. *PHEROPSOPHUS VERTICALIS*, Dej.

Mast. Cat. Col. Sp. 101.

Two apparently distinct insects, and both unlike the specimens from the East and South of Australia, are contained in Mr. Froggatt's collection, but I cannot detect any differences which would justify the creation of a new species.

Sub-Family LEBIIDES.

24. *TRIGONOTHOPS FASCIATA*, n.sp.

Reddish-testaceous, nitid. Head smooth, a little prolonged triangularly to the labrum, narrowed into a short neck immediately behind the eyes. Thorax broader than long, rather broader than the head at the eyes, rounded on the sides and amplified above the middle, narrowed again to the base which is of the width of the apex, but truncate, the sides with a broad, slightly recurved margin, having an erect seta on the anterior third at the widest part, and another at the posterior angles which are rectangular and sharp, the median line is distinctly canaliculate. The elytra are wider than the thorax and about three times the length, slightly amplified behind, and finely striate with the interstices flat; there is a deep dark brown spot at the base on each side of the scutellum, and a broad fascia of the same colour near the apex. The tarsi are broad, the fourth deeply bilobed.

Length, $3\frac{1}{2}$ lines.

25. *TRIGONOTHOPS PALLIDIOR*, n.sp.

This species closely resembles *T. fasciata*, but it is altogether of a paler colour, excepting, perhaps, the head, which is also less smooth and more deeply impressed in front. The elytra are of a very pale yellow, and minutely striate-punctate, with a large irregular faint brown fascia near the apex.

Length, $3\frac{1}{2}$ lines.

26. *TRIGONOTHOPS NIGRICOLLIS*, MacL.

Mast. Cat. Col. Sp. 107.

27. *TRIGONOTHOPS ORNATA*, n.sp.

Pale testaceous, nitid. Head reddish-testaceous, a deep transverse curved depression between the eyes. Thorax as in *T. fasciata*, transverse. Elytra broader than the thorax and about three times the length, flat, finely striate and very minutely punctate, with a brown spot on each side of the suture near the base, and a lateral marginal band and a broad irregular fascia near the apex of the same colour. The tarsi are of a rather darker colour than the rest of the legs.

Length, $2\frac{3}{4}$ lines.

The colouration and markings of this species resemble very much those of *T. pallidicollis*, MacL., and *T. fasciata*, MacL., but it is very different and very much smaller.

28. *XANTHOPHÆA VARIABILIS*, n.sp.

Colour varying in different specimens from piceous red to pale testaceous. Head sub-elongate, punctate, impressed on each side in front of the eyes. Thorax not broader than the head, longer than broad, slightly cordiform, punctate, narrowed a little near the base, with the base truncate and the angles acute. The margins of the thorax are of a lighter colour than the disk. The elytra are broader than the thorax and about three times the length, finely striate, the interstices flat and finely punctate, a very narrow pale lateral border, and in contact with it a broad dark vitta, sometimes indistinct, extending from the humeral angles to the apex, and gradually widening to the apex.

Length, 4 lines.

29. *EULEBIA PLAGIATA*, MacL.

Mast. Cat. Col. Sp. 146.

30. *SARATHROCREPIS DIMIDIATA*, n.sp.

Reddish-testaceous, nitid. Head sub-elongate in front of the eyes, short behind, smooth and convex on the occiput, impressed in front on each side and in the middle, eyes large, prominent. Thorax slightly transverse, the apex and base of equal width, but the anterior angles much rounded, the posterior acute with the margin broadly reflexed, the median canal is well-marked and the whole disk is very minutely rugosely punctate. The elytra are slightly broader than the thorax at the base, and more than three times the length, are amplified on the sides to near the apex, and are striated and very minutely punctate, the interstices slightly raised; the posterior part of the elytra is black nearly to the middle.

Length, $3\frac{1}{2}$ lines.

S. posticalis, Guérin, which somewhat resembles this species is *inter alia* much larger, has the thorax almost concave on the apex, and is much smoother on the disk.

31. *SARATHROCREPIS LITURATA*, n.sp.

Very pale testaceous, nitid. Head short, smooth between the eyes, with a short linear impression on each side of the clypeus commencing on the edge of the forehead. Thorax broader than the head, much broader than long, the anterior angles rounded, the sides also rounded, the base broader than the apex, and the posterior angles rectangular, sharp and broadly margined. Elytra a little broader than the thorax at the base, and considerably amplified behind, striate and very minutely punctate, with a narrow zigzag black fascia extended on the suture, on the apical third.

Length, $1\frac{3}{4}$ lines.

32. *SARATHROCREPIS NOTATA*, n.sp.

Pale reddish-testaceous and nitid. Head more triangularly prolonged in front than in *S. liturata*, but otherwise very similar. Thorax also of the same form. Elytra of similar proportions and

more distinctly striate-punctate, with a large black triangular patch, common to both elytra, behind the middle, the base of the triangle uppermost; also, one or two small black spots near the sides at the apical third.

Length, $2\frac{3}{4}$ lines.

33. SARATHROCREPIS NOTABILIS, n.sp.

Of the size and general appearance of *S. liturata*, but the head more triangular in front, and the impression on each side of the clypeus and forehead extending to between the eyes, the thorax smoother, the elytra more amplified. On each elytron at the suture at the apical third is a square black spot, which gives the appearance of a short abbreviated fascia common to both.

Length, 2 lines.

The number of species of this genus in Australia is something wonderful, many of them still undescribed, and many of those described have been so imperfectly characterised as to make it extremely difficult to tell what is new or what is old. I believe, however, that in this respect I have made no mistake in the above four species.

34. PLOCHIONUS HUMERALIS, n.sp.

Dark pitchy brown, nitid. Head linearly impressed on both sides from the eyes forwards, with a horse-shoe-shaped impression in the middle; the labrum is shorter than the width, and rounded in front; the eyes are large and prominent. Thorax transverse, broader than the head, nearly truncate in front and behind, the anterior angles very round, the posterior rectangular and acute, the lateral margins broad, broadest at the posterior angles, and of a reddish colour; the disk sub-convex, and very finely transversely striolate and canaliculate in the middle. Elytra much broader than the thorax and three times the length, strongly striate and extremely minutely punctate, the base concave in the middle, the

humeral angles round and rather protruding, the sides amplified a little to near the apex; the extreme lateral edge is yellowish, and a broadish vitta of a dull red colour extends from the base to near the middle in the centre of each elytron. The under surface and legs are reddish testaceous.

Length, 4 lines.

35. *PLOCHIONUS SEMIVITTATUS*, n.sp.

Very dark brown, nitid. Head as in *P. humeralis*, but more lightly impressed in front, the thorax rather more transverse than in that species, with the lateral margins yellow and broad. Elytra scarcely broader than the thorax, finely striate, the interstices flat and extremely minutely punctate, a very narrow lateral border, an elongate oval patch extending from the base near the shoulder to the middle, and an apical patch, yellow. The abdomen and legs pale testaceous.

Length, $2\frac{1}{4}$ lines.

I think I am right in associating these two species with the genus *Plochionus*. They are in fact simply *Lebiae* with securiform labial palpi.

Sub-Family PERICALIDES.

36. *PHILOPHLÆUS FROGGATTI*, n.sp.

Black, nitid. Head smooth on the occiput, with a somewhat corrugated impression on each side in front, the clypeus transverse, the labrum not longer than the width and roundly pointed, the antennæ of a reddish tinge. Thorax broader than the head, the width near twice the length, very nitid, the apex truncate, the sides widening to the anterior third, where the margin is angled and setigerous, narrowed a little behind to the posterior angles, which are acute and prominent, the base is truncate, the median canal very profound. Elytra broader than the thorax, and little more than twice the length, striate, densely and finely punctate, with a broad dull red vitta in the middle of each elytron, not quite touching the base or apex.

Length, $2\frac{3}{4}$ lines.

37. *SCOPODES DENTICOLLIS*, MacI.

Mast. Cat. Col. Sp. 207.

38. *SCOPODES SEXFOVEATUS*, n.sp.

In size, form, and sculpture this species exactly resembles *S. denticollis*, but the colour is of a more brilliant golden bronze, and the three foveæ near the suture of the elytra are larger and deeper.

Long. 2 lines.

Sub-Family PSEUDOMORPHIDES.

39. *SILPHOMORPHA SPECIOSA*, Pascoe.

Mast. Cat. Col. Sp. 246.

40. *SILPHOMORPHA STRIATIPENNIS*, n.sp.

Black, nitid, the width one-half of the entire length. Head nearly square, slightly convex, minutely striate, forming a rounded prominent angle in front of the eyes, and slightly depressed near the anterior angles. Thorax very transverse, three times wider than long, and very minutely and rugosely punctate, with the median canal scarcely traceable on the apical half only. Elytra of the width of the thorax, one-fourth longer than the width, striate-punctate, with the interstices broad, flat and minutely punctate, the lateral groove with a few large punctures, and suddenly widened internally for a short space behind the humeral angles. Legs and under surface of a pitchy nitid black.

Long. 6 lines, lat. 3 lines.

The species resembles in general appearance a number of other species, especially *S. Mastersii*, MacI., but the striation and puncturation of the elytra are more profound, and the whole insect is of a comparatively shorter and broader form.

41. SILPHOMORPHA LÆVIS, Casteln.

Mast. Cat. Col. Sp. 231.

42. SILPHOMORPHA POLITA, MacL.

Mast. Cat. Col. Sp. 240.

43. SILPHOMORPHA FROGGATTI, n.sp.

Black, nitid, of almost the same proportional dimensions as *S. striatipennis*, the head more transverse, the thorax quite smooth with the margins piceous, and the elytra very finely striated with a row of minute slightly distant punctures on each stria and the interstices flat and smooth. The under surface and legs are piceous.

Long. 6 lines, lat. $2\frac{7}{8}$ lines.

44. SILPHOMORPHA LATICOLLIS, n.sp.

Black, nitid, proportionally broader than *S. Froggatti*, and in other respects very similar. The elytra are more nitid and the punctate striæ are very fine and apparently most distinct near the apex.

Long. $5\frac{1}{2}$ lines, lat. 3 lines.

45. SILPHOMORPHA OBSOLETA, n.sp.

Very like the last-named species in general character. Black, sub-nitid, minutely punctate all over; the punctate striæ of the elytra nearly obsolete, the lateral margins broader and of a piceous hue.

Long. $6\frac{1}{3}$, lat. 3 lines.

46. SILPHOMORPHA PUNCTATISSIMA, n.sp.

Black, nitid, of broadly ovate form; head smooth, thorax of the usual form, very minutely punctate, the apex less emarginate than in the other species, with the lateral margins smaller, the base truncate and the posterior angles less rounded. The elytra are rounded a little on the sides, and are wider a little than the

thorax, they are entirely and densely minutely punctured, with the usual punctured striæ very obsolete.

Long. 4 lines, lat. $2\frac{1}{2}$ lines.

47. SILPHOMORPHA CENTRALIS, n.sp.

Ovate, flat; the width one-half the total length, black, nitid, smooth; anterior angles of the thorax acute and prominent, lateral margin not reflected, the base truncate. Elytra slightly broader than the thorax and a little longer than the breadth, with a roundish orange spot on the suture about the middle of the length common to both elytra. Under surface reddish-piceous.

Long. 4 lines, lat. $2\frac{1}{2}$ lines.

The species most resembling this is *S. maculigera*, MacL., from Port Denison.

48. SILPHOMORPHA ORNATA, n.sp.

Broadly ovate, black, nitid, smooth. Head smooth; not prominently angled in front of the eyes. Thorax deeply emarginate in front, with the anterior angles prominent but scarcely acute, and the lateral margins wide, recurved, and of a bright yellow colour. Elytra scarcely wider than the thorax, as wide as the length, and very obsoletely striate, with a broad lateral vitta, a broad ragged edged fascia proceeding from it near the base to near the suture, and another less broad near the apex from the lateral vitta to close to the suture, of a pale yellow. Beneath dark piceous.

Long. $4\frac{1}{2}$ lines, lat. $2\frac{1}{2}$ lines.

This species in its peculiar markings comes nearest to *S. nitiduloides*, Guérin.

49. SILPHOMORPHA FLAVICOLLIS, n.sp.

Rather narrower than *S. ornata*. Head black, smooth. Thorax entirely yellow, shorter than in the preceding. Elytra longer than the width, striate, finely rugose, black, with yellow

lateral margins, a fascia from it near the base almost to the suture, and another of the same wavy character near the apex, but much wider than in *S. ornata*. The under surface is pale piceous.

Long. 4 lines, lat. $2\frac{1}{4}$ lines.

50. *SILPHOMORPHA BIVITTATA*, n.sp.

Black, nitid. Head and thorax slightly opaque, the latter longer a little than usual in the genus, not much emarginate in front, scarcely rounded at the posterior angles, with a thin reddish lateral margin. Elytra nearly as wide as long and quite smooth, with a very narrow reddish lateral margin, and a broad yellow vitta, widest on the anterior portion, extending from the middle of the base of each elytron almost to the apex near the suture. Beneath piceous.

Long. $2\frac{3}{4}$ lines, lat. $1\frac{1}{2}$ line.

51. *ADELOTOPUS BREVIPENNIS*, n.sp.

Ovate, black, nitid, smooth, subconvex. Head transverse, broadly rounded in front. Thorax a little wider than the length, a little emarginate in front to receive the head, much reflected on the lateral margins, wider at the base than at the apex, and truncate, with the posterior angles acute. Elytra about the width of the thorax, twice the length, and broadly truncate at the apex, with the lateral margins less widely reflected than those of the thorax. Beneath piceous black, very nitid.

Long. 3 lines, lat. $1\frac{1}{2}$ line.

This species differs in the shorter and broader body from all of the genus I have seen.

52. *ADELOTOPUS ELONGATULUS*, n.sp.

Elongate, black, nitid, smooth, subconvex. Head as in the last-described species. Thorax of the same form, but the lateral margins narrower and of a piceous hue, and all the angles very

acute. Elytra of the width of the thorax, nearly three times the length, parallel-sided and narrowly margined. Beneath piceous.

Long. 3 lines, lat. 1 line.

53. *ADELOTOPUS LONGIPENNIS*, n.sp.

Elongate, reddish-brown, nitid. Thorax nearly as long as the width, with the lateral margins rather broadly reflected. Elytra very slightly narrower than the thorax and nearly three times the length, parallel-sided and obsoletely striate and very faintly punctate. Beneath pale piceous, nitid.

Long. 3 lines, lat. 1 line.

54. *ADELOTOPUS LÆVIS*, n.sp.

A very small species of almost a cylindrical form, elongate, convex, smooth, very nitid and of a pale reddish-piceous colour, a little darker on the head and thorax. The reflexed margins are rather narrow, and the elytra are slightly narrower than the thorax.

Long. $1\frac{1}{3}$ line, lat. $\frac{1}{2}$ line.

55. *ADELOTOPUS LINEARIS*, n.sp.

Elongate, cylindrical, the sides parallel from the head to the extremity of the elytra, sub-nitid. Head black, very round and convex in front. Thorax black, longer than the width, scarcely broader than the head, the lateral margins much reflected, but not very wide, the apex and base both truncate. Elytra black at the base, the remainder of a dark red, narrow and elongate.

Long. $2\frac{1}{2}$ lines, lat. $\frac{3}{4}$ line.

Sub-Family SCARITIDES.

56. *CARENOSCAPHUS VIRIDISSIMUS*, n.sp.

Elongate, metallic green, very nitid. Head black, nearly square, the frontal canals diverging behind. Thorax very little broader than the head, longer than broad, sub-truncate at the apex,

parallel-sided for three-fourth of the length, and rounded at the posterior angles, with the base much narrowed and shortly lobed, the median line is strongly marked from near the apex, and there is a very marked depression near the base at the posterior angles. Elytra narrower than the thorax and twice the length, slightly narrower at the base than behind, depressed a little on the suture, rather faintly but distinctly striate-punctate with an impressed puncture near each shoulder, another towards the apex, and a regular series of strong punctures in the lateral margins. Beneath black, the anterior tibiae very strongly bidentate externally.

Long. 9 lines, lat. $2\frac{1}{2}$ lines.

This insect has much the appearance of an *Eutoma*, but the less securiform palpi, the short moniliform antennæ, and less notched anterior femora seem to mark its approach to the next group which I have named *Carenoscaphus*. In fact the resemblance to *C. quadripunctatus*, Macl., is very striking.

57. CALLISCAPTERUS VIRIDIÆNEUS, n.sp.

Oblong-oval, brilliant metallic green on the upper surface with a purplish tinge on the apex of the thorax, and the sides and disk of the elytra. Head large, transverse, the frontal grooves diverging a little behind. Thorax transverse, wider than the head, the anterior angles prominent, the lateral margins reflected and narrowed to a short lobe at the base, the basal impression on each side shallow, and the median canal deep. Elytra shortly oval, about the width of the thorax at the widest part and about twice its length, faintly striate-punctate, the base a little emarginate and punctate, the humeral angles thick, prominent and a little recurved, the disk flattish, the lateral margins with a row of deep punctures and a large puncture on each elytron about the apical fourth. Beneath black, the anterior tibiae tridentate externally.

Long. $5\frac{1}{4}$ lines, lat. $2\frac{1}{2}$ lines.

Except for its much smaller size and acutely shouldered elytra, this species might almost be taken for *C. coruscus*, Macl., a species from some part of Northern Australia, and unique in my collection.

58. *CALLISCAPTERUS FOVEOLATUS*, n.sp.

Very like the last-named species, but smaller, of narrower form, and of bluish-green colour; the frontal grooves are more parallel, the elytra are narrower than the thorax, and have two fovea-like punctures on each elytron, one nearly one-third of the length from the base, the other about the same distance from the apex. Anterior tibiæ tridentate.

Long. $4\frac{1}{2}$ lines, lat. $1\frac{3}{4}$ line.

59. *SCARAPHITES LATICOLLIS*, Macl.

Mast. Cat. Col. Sp. 458.

60. *GEOSCAPTUS LÆVISSIMUS*, Chaud.

Mast. Cat. Col. Sp. 469.

61. *GEOSCAPTUS APPROXIMATUS*, Macl.

Mast. Cat. Col. Sp. 467.

Of the *Clivina* group of this sub-family the collection contains 17 distinct species, but I must defer any attempt to describe them until I can procure Putzey's "Révision Générale" of the Clivinidæ, the most complete work on the subject ever published.

Sub-Family PANAGEIDES.

62. *EUDEMA NOBILE*, n.sp.

In size this species approaches most nearly to *E. convexum*, Macl., but it is of more elongate form. The thorax is of very different form, being longer than the width, the apex not wider than the head, the sides roundly amplified to behind the middle, but not so much or so angularly as *E. convexum*, and narrowed from that to the base, with the posterior angles reflected and the base about equally as wide as the apex. The elytra are more oval and less globular than in *E. convexum*, but the sculpture and markings are identical.

Long. 8 lines.

63. EUDEMA PARVULUM, n.sp.

Most like *E. Australe*, but smaller and of a broader form, the thorax rather wider than long, and less coarsely punctate; the elytra much shorter and comparatively wider, in other respects identical.

Long. $4\frac{1}{2}$ lines.

Sub-Family CHLÆNIDES.

64. CHLÆNIUS AUSTRALIS, Dej.

Mast. Cat. Col. Sp. 541.

I believe this to be *C. australis*, but in all the specimens from other parts of Australia the thorax is of a green metallic colour, whereas the King's Sound specimens have the thorax of a coppery red.

65. CHLÆNIUS SUBCOSTATUS, MacL.

Mast. Cat. Col. Sp. 551.

66. CHLÆNIUS MACULIFER, Casteln.

Mast. Cat. Col. Sp. 545.

67. OODES FROGGATTI, n.sp.

Like *O. riverinæ*, Macleay, oblong-ovate, bronzy-black, nitid. Thorax narrower in front than behind, sub-truncate at base and apex, very smooth, the median line showing merely as a faint scratch, with two shallow depressions on each side near the base. Elytra scarcely wider than the thorax at the base, very finely striate, the short scutellar stria scarcely traceable, a deep punctiform impression at the base at the junction of the first and second striæ from the suture, and two small punctures close to the second stria on the interstice between that and the second stria—one near the middle of the elytra, the other near the apex. Beneath black, nitid.

Long. 7 lines.

This would probably be a *Coptocarpus* of Chaudoir.

68. OODES. FITZROYENSIS, n.sp.

In form and general appearance much like *O. australis*, Dej. black, nitid, smooth, the clypeal suture marked with minute punctures, and a stronger puncture on each side. The median line of the thorax finely impressed, a deeply impressed fovea on each side of it at the base. The striæ of the elytra are well marked, the interstices flat and smooth, the scutellar stria is distinct and punctate, and is about twice the length of the scutellum, the impressions on the base of the thorax are continued on to the elytra at the union of the second and third striæ, and the two punctures on the third interstice are smaller and farther from the apex than in *O. Froggatti*.

Long. 5 lines.

69. OODES PYGMÆUS, n.sp.

Black, nitid, piceous on the lateral margins. Thorax strongly bi-impressed at the base. Elytra ovate, deeply striate with the interstices subconvex, the scutellar stria deep and more than twice the length of the scutellum, the two punctures on the third interstice placed as in *O. Froggatti*. Beneath piceous, antennæ and palpi reddish.

Long. 3 lines.

70. OODES LILLIPUTANUS, n.sp.

Black, nitid, the elytra slightly bronzy. Thorax finely canaliculate in the middle, the basal impressions distinct. Elytra of the width of the thorax at the base, not widened behind and rounded at the apex; they are finely striate-punctate with the interstices flat and smooth; the scutellar stria is about three times the length of the scutellum, and the punctures on the third interstice are placed, one about the middle, the others half way between the first and the apex. The legs and margin of thorax and elytra are reddish-yellow.

Long. $2\frac{1}{2}$ lines.

Sub-family STOMIDES.

71. DARODILIA CASTELNAUI, n.sp.

Oblong, black, very nitid; head very smooth, with a puncture on each side in front of the eyes, the labrum much emarginated. Thorax longer than broad, sides regularly rounded, apex and base subtruncate, the latter slightly the narrower, with a very slight median canal and a deep impression near each posterior angle. Elytra rather wider than the thorax and about twice the length, the humeral angles rounded, the sides parallel, and the apex rounded, with four distinct punctate striæ on each elytron, and the sides smooth, without striæ.

Long. 4 lines.

Count Castelnau founded this genus for an insect from the Lachlan, which I have never seen.

Sub-Family CRATOCERIDES.

72. PHORTICOSOMUS NUYTSI, Casteln.

Mast. Cat. Col. Sp. 652.

Sub-Family HARPALIDES.

Under this sub-family I include the *Anisodactylides*, as the two sub-families approach very closely, and are not easily separated from one another. Baron de Chaudoir has found that all the species of *Harpalus* hitherto described from Australia by Castelnau and others, are really of the sub-family *Anisodactylides*.

73. GNATHAPHANUS PULCHER, Dej.

Mast. Cat. Col. Sp. 664.

74. DIAPHOROMERUS POLITUS, n.sp.

Elongate-ovate, black, nitid. Head a little narrowed between the eyes, considerably narrowed in front, very smooth, a light

depression on each side close to the clypeal suture, and another larger at the sides of the clypeus, the palpi reddish-yellow, the antennæ with the first joint pale red, the second, third, fourth and fifth brownish, the remainder reddish. Thorax a little wider than the head, and a little wider than the length, the apex almost truncate, the base scarcely wider than the apex and quite truncate, the sides lightly rounded and the angles obtuse; the median line and basal depressions not profoundly marked. Elytra wider than the thorax and nearly three times the length, strongly striate, the interstices smooth and very slightly convex, a short stria near the scutellum of about three times the length of it, on the interstice between the first and second striæ and not running quite into either of them, the apex of the elytra very slightly sinuate. Under surface and legs piceous, the first four joints of the four anterior tarsi strongly dilated in the male, the fourth joint bilobed, the anterior thighs short, thick, and somewhat compressed.

Long. 4 lines, lat. $1\frac{1}{3}$ line.

75. DIAPHOROMERUS SEXPUNCTATUS, n.sp.

Elongate-ovate, black, nitid. Head as in the last species, the antennæ and palpi piceous red, the third joint of the former longer than the following. Thorax nearly square, the angles rounded, the sides a little rounded, the median canal and the basal depressions slight. Elytra very slightly bronzy, not wider than the thorax, very slightly amplified from the humeral angles, three times the length of the thorax, striate, and the interstices flat, with the short basal stria running out into the first stria at about one-seventh of the length, and with six well-impressed punctures on the third interstice, commencing about one-fifth of the length from the base, and extending to the very apex at nearly equal distances. Body beneath and legs piceous, the thighs thick and compressed, the four first joints of the four anterior tarsi dilated in the male.

Long. $4\frac{1}{2}$ lines, lat. $1\frac{3}{4}$ line.

76. *DIAPHOROMERUS MULTIPUNCTATUS*, n.sp.

Elongate-ovate, nitid; head and thorax black; elytra brownish-sericeous; the antennæ, palpi, and legs more or less pale testaceous. The head resembles that of the last two species; the labrum is piceous, the first joint of the antennæ paler than the others. Thorax slightly wider than long, and slightly wider at the base than the apex, the angles and the sides a little rounded, the median line lightly, and the basal impressions deeply marked. The elytra are very slightly wider than the thorax and very slightly rounded on the sides, and are of semi-opaque faintly silky-brown appearance, striate, the interstices flat, the short basal stria not running into either the first or second stria, a series of about ten deep punctures on the third stria or second interstice extending from base to apex, and about six on the fifth stria, on the posterior two-thirds. The legs are rather strongly hairy, the four first joints of the four anterior tarsi of the male dilated, but not so broadly as in the foregoing species.

Long. 3 lines, lat. $1\frac{1}{4}$ line.

77. *DIAPHOROMERUS SULCATULUS*, n.sp.

Elongate-ovate, black, moderately nitid. Head smooth, sub-convex, clypeal suture distinctly marked, clypeus rather longer than usual in the genus and slightly emarginate, the palpi and antennæ ferruginous, the first joint of the latter paler than the rest. Thorax rather transverse, with the base wider than the apex, the sides a little rounded, the angles sub-obtuse, and the discal impressions very shallow. The elytra are slightly inclined to widen from the base and are slightly wider than the thorax, deeply striate, the interstices smooth, and sub-costate, the short basal stria of the usual length, and not extending into either the first or second stria, with about four small punctures on the third interstice commencing about the anterior fourth; scarcely any emargination at the apex. Beneath black, legs piceous. A female specimen.

Long. 5 lines, lat. 2 lines.

78. DIAPHOROMERUS LATICOLLIS, n.sp.

Oblong-ovate, black, nitid, elytra sub-opaque. Head smooth, the puncture on each side between the eyes and the clypeal suture distinct, the palpi and antennæ piceous, the third joint of the latter rather longer than the fourth. Thorax much broader than the head, nearly square, the sides a little rounded, the angles a little obtuse, and the dorsal impressions large but shallow. Elytra very slightly wider than the thorax, and little over twice the length; strongly striate, the interstices slightly convex, the short basal stria almost extends into the first stria, on the second interstice from the suture which is rather narrower than the others, there are five rather small punctures, the first about one-fourth of the length from the base, the second, third, and fourth at about equal distances apart, the fifth close to the fourth and the apex. Under surface very nitid. Legs piceous; thighs moderately enlarged and compressed. One female specimen.

Long. 5 lines, lat. 2 lines.

78. DIAPHOROMERUS FROGGATTI, n.sp.

Oblong-ovate, black, nitid, the elytra a little duller. Head as in the last species, the labrum arched and emarginate at the apex, the palpi and antennæ piceous, the first joint of the latter almost yellow, the second quite half the length of the third. Thorax wider than the head and wider than long, the sides well rounded, the base not wider than the apex, and the posterior angles very obtusely rounded; the discal impressions well marked. Elytra wider than the thorax and three times the length, striate, but not so strongly as in *D. laticollis*, and with the interstices more flat, the short basal stria not running into the first stria, five or six rather small punctures on the second interstice from the suture extending from near the base to the apex, and two or three others on the fourth interstice at the basal half. Legs pale piceous, thighs only slightly swollen, sub-elongate, the antennæ rather elongate, quite half the length of the body. One female specimen.

Long. $4\frac{1}{2}$ lines, lat. $1\frac{3}{4}$ line.

79. DIAPHOROMERUS PORCATULUS, n.sp.

Elongate-ovate, black, nitid, elytra bluish-black. Head as in preceding species, antennæ reaching the base of the thorax, of a reddish colour. Palpi also reddish, rather obtusely pointed. Thorax wider than the head, much wider than long, much rounded on the sides and posterior angles, the base rather narrower than the apex, the median line and basal depressions well marked, and a broad transverse depression near the base. Elytra scarcely if at all wider than the thorax, and over three times the length, very strongly striate or grooved, the interstices convex, the short basal stria longer than usual, and not running into the first stria; the first four interstices from the suture are marked with punctures, very irregular as to the numbers. Legs dark piceous, thighs slightly swollen, the anterior tarsi of the male very slightly dilated. The female is wider in the body.

Long. 5 lines, lat. 2 lines.

80. DIAPHOROMERUS OPACUS, n.sp.

Oblong-ovate, black, subnitid, the elytra opaque and of a brownish-black. Head small, clypeus a little emarginate, labrum short, palpi reddish, rather acutely pointed, antennæ also red, the terminal joints pubescent. Thorax wider than long, the anterior angles slightly prominent, the sides a little rounded behind them, very little narrowed to the base which is rather wider than the apex, the posterior angles almost rectangular. Elytra wider than the thorax, and nearly three times the length, covered with a very minute greyish pubescence as in some species of *Chlænium*, very finely striate, the interstices flat, the short basal stria running parallel and close to the second stria. Legs pale yellow, the first four joints of the four anterior tarsi of the male, enlarged, scarcely dilated.

Long. 3 lines, lat. $1\frac{1}{4}$ line.

81. *DIAPHOROMERUS NIGRANS*, n.sp.

Oblong-ovate, black, very nitid, the antennæ, palpi, and legs, red. Head smooth, the clypeal suture and punctate impression on each side of it lightly marked, the clypeus short and emarginate, the palpi acute. Thorax wider than the head and nearly square, the sides a little rounded, the median line distinct from near the base, the basal impressions and transverse basal depression minutely punctate. Elytra about the width of the thorax at the base, about twice the length, widening a little from the shoulder to near the apex which is broadly rounded and scarcely sinuate, deeply striate, the interstices smooth and nearly flat, the short basal stria long and not running into the first, one or two very inconspicuous punctures towards the apex of the second interstice. The anterior tarsi of the anterior legs of the male a little dilated.

Long. 3 lines, lat. $1\frac{1}{2}$ line.

82. *DIAPHOROMERUS SERICIPENNIS*, n.sp.

Very like the last, but smaller, the clypeal suture more profoundly marked, the thorax more transverse, the basal impressions shorter, and the transverse depression between them deeper and smoother. Elytra of the same oval form, but of a deep silky brown colour, with one puncture near the apex of the second interstice. Antennæ, palpi and legs pale red, the four anterior tarsi slightly enlarged.

Long. $2\frac{1}{2}$ lines, lat. 1 line.

83. *STENOLOPHUS SUTURALIS*, n.sp.

Oblong, black, nitid, thorax red. Head triangular, deeply impressed on each side between the eyes, the palpi red and rather acutely pointed, the antennæ brownish excepting the first two joints, which are yellow. Thorax almost square, wider than the head, the sides slightly rounded, the posterior angles very obtuse, and the basal impressions large, shallow and minutely punctate.

Elytra slightly wider than the thorax and three times the length, rather square at the humeral angles, not ampliate behind, striate, the interstices nearly flat, the short basal stria about twice the length of the scutellum and not running into the first stria, with a narrow sutural vitta not quite reaching the scutellum, a somewhat transverse spot near the humeral angles, and a longish spot near the apical angle, of a deep red. Legs yellow, thighs moderately dilated, the anterior four tarsi considerably enlarged.

Long. 3 lines, lat. 1 line.

84. *HYPHARPAX VARUS*, n.sp.

Oblong-ovate, sub-convex, black, very nitid. Head rather obtuse, smooth, a deep punctiform impression on each side between the eyes, antennæ piceous, the second joint half as long as the third. Thorax with a faint greenish lustre, wider than the head and wider than long, the sides a little rounded and thickly margined, the base truncate and slightly wider than the apex, the posterior angles nearly rectangular, the basal impressions in the form of deep rounded foveæ, connected by a light transverse depression. Elytra rather wider than the thorax, and not three times the length, less nitid than the thorax and with a slight purplish hue, striate, the striæ near the base very profound, the interstices flat, a very short deep stria extending diagonally from the base of the second stria. Legs piceous, posterior thighs short, much swollen and curved, emarginate and toothed beneath, the tibiæ also much curved, the tarsi of the anterior legs of the male broadly dilated, those of the intermediate legs less so.

Long. 5 lines, lat. $1\frac{3}{4}$ line.

85. *HYPHARPAX OPACIPENNIS*, n.sp.

Differs from the last species in having the thorax a little more green, the posterior angles more obtuse, the basal impressions very light, and the median line more distinct. The elytra are subsericeous and opaque, the striæ finer than in *H. varus*, the interstices more flat, and the short stria from the base of the

second stria is longer and more acute. The posterior thighs are very thick and curved, but rather less so than in *H. varus*, and the tibiæ are rather thicker.

Long. 5 lines, lat. 2 lines.

86. *HAPLANER MARGINATUS*, n.sp.

Oblong-ovate, brownish-black, nitid, thorax and elytra narrowly margined with yellowish, the latter subsericeous. Head smooth, the impressions on each side in front extending in a deep line upwards to the eyes, the first and second joints of the antennæ yellowish. Thorax slightly wider than the head, nearly square, a little rounded on the sides, not wider behind than in front, the posterior angles obtuse, and the base depressed and minutely punctate. Elytra wider than the thorax and $2\frac{1}{2}$ times the length, striate, the interstices flat, no vestige of a short stria at the base, the apex rounded. Legs yellowish, rather slender, the anterior tarsi slightly enlarged.

Long. $3\frac{1}{2}$ lines, lat. $1\frac{1}{4}$ line.

I believe this and the following species may be considered as belonging to Chaudoir's genus *Haplaner*, though differing somewhat from his description. The entire absence of the short basal stria of the elytra is the most striking feature, and in that they are all alike.

87. *HAPLANER RECTICOLLIS*, n.sp.

Black, nitid. Head small, deeply impressed on each side between, and in front of, the eyes, mandibles curved, acute, palpi acute, these and the antennæ reddish. Thorax wider than the head and longer than wide, much rounded on the sides to near the base, then straight to the base with the angles acute, the base truncate, slightly wider than the apex, the median line lightly marked, the basal depression larger and deep, the base transversely depressed and finely punctate. Elytra much wider than the thorax, and scarcely more than twice the length, very strongly

striate, the striae becoming fewer near the sides, the interstices convex. Legs reddish-yellow, rather slender, the anterior tarsi of the male moderately dilated, the intermediate very slightly.

Long. $3\frac{1}{4}$ lines, lat. 1 line.

88. *HAPLANER PUNCTICOLLIS*, n.sp.

Black, moderately nitid, the elytra with a reddish-brown tinge, the legs, antennae and palpi piceous-red. Head smooth, with a large punctiform impression on each side at the clypeal suture. Thorax about as wide as long, rather convex, rounded on the sides, nearly rectangular at the base, the basal depression large, shallow, and densely and finely punctate. Elytra a little wider than the thorax and little more than twice the length, slightly opaque, very deeply striate, the interstices convex, no short basal stria. Legs rather slight, the posterior thighs short and curved a little as in *Hypharpax*, the anterior tarsi slightly dilated.

Long. $2\frac{3}{4}$ lines, lat. 1 line.

89. *HAPLANER SUBSERICEUS*, n.sp.

Ovate, sub-depressed, black, very nitid, elytra silky-brown. Head with the usual impressions, but not strongly marked, the palpi and antennae piceous. Thorax transverse, wider than the head, slightly rounded on the sides, rectangular behind, the median line rather faint, and the basal impressions deep but not large. Elytra wider than the thorax, and little over twice the length, rounded slightly on the sides, rounded and slightly emarginate at the apex, finely striate, the interstices flat, the first stria from the suture deep throughout, the second deep at the base only, no short stria. Legs piceous-red, hind thighs short and thick, tibiae spinous-hairy.

Long. $2\frac{1}{2}$ lines, lat. 1 line.

90. *HAPLANER ASSIMILIS*, n.sp.

Resembling *H. puncticollis* in every respect excepting that it is much larger, and of a piceous-red all over, the thorax more

rounded on the sides with a narrow reddish margin, and much rounded at the posterior angles. The four anterior joints of the four anterior tarsi of the male are transversely dilated ; in all else like *H. puncticollis*.

Long. $3\frac{1}{4}$ lines, lat. 1 line.

91. ACUPALPUS ORNATUS, n.sp.

Elongate-oval, black, very nitid. Head broad, blunt, very lightly impressed in front of the eyes, the clypeus broadly emarginate. Thorax scarcely wider than the head, about as wide as the length, a little emarginate at the apex, much rounded on the sides, narrowed to the base, which is narrower than the apex, and very round at the posterior angles, the disk very smooth and a little convex, with a transverse line near the base. Elytra wider than the thorax and twice the length, the humeral angles squarely rounded, the sides very slightly rounded, very finely striate, the interstices flat, the first stria from the scutellum short, reaching one-eighth of the length of the elytra, an orange oblong spot near each humeral angle, diagonally placed, and another, also oblong, placed in the middle of each elytron near the apex. Legs pale piceous.

Long. 2 lines, lat. $\frac{1}{2}$ line.

92. ACUPALPUS QUADRIMACULATUS, n.sp.

Sub-elongate-oval, black, nitid. Head less large than in the preceding species, and the punctiform impression on each side in front of the eyes deeper. The thorax is wider than the head and a little wider than long, the sides moderately rounded and very narrowly margined with yellow, the posterior angles rounded, the base as wide as the apex, the median line distinctly impressed and the basal impressions wide, very shallow and very minutely punctate. Elytra scarcely wider than the thorax and more than twice the length, striate, the interstices rather convex, a short stria at the base of the second interstice, a small elongate spot near each

humeral angle, and another larger near the apex and towards the sides of each elytron, of a pale yellow. Legs pale yellow; antennæ brownish, the first two joints paler.

Long. 2 lines, lat. $\frac{3}{4}$ line.

93. *ACUPALPUS BIMACULATUS*, n.sp.

This species exactly resembles the preceding, differing only in being a little less nitid, in the much finer striation of the elytra, the flatter interstices, and in wanting the humeral spot.

Long. $2\frac{1}{4}$ lines, lat. $\frac{3}{4}$ line.

There are a few other *Harpalides* in the collection, single specimens, which I cannot well make out without sacrificing the insects.

Sub-Family FERONIDES.

94. *CATADROMUS ELSEYI*, White.

Mast. Cat. Col. Sp. 760.

95. *CRATOGASTER OCCIDENTALIS*, n.sp.

Of more elongate form than *Cratogaster sulcatus*, Blanch., black, nitid. Head not longer than wide not including the labrum, that emarginate, a deep impression on each side between the eyes, the anterior angles of the head almost acutely prominent. Thorax much wider than the head, nearly as long as wide, sub-convex, anterior angles slightly prominent, sides rounded with a thick recurved margin, the posterior angles obtuse, the base about the same width as the apex, the median line deep, the basal impressions deep, linear, about one-third of the length of the thorax, and a short deep linear impression close to the posterior angles on each side. Elytra wider than the thorax, and rather over twice the length, convex, the humeral angles sub-acute, deeply striate, the interstices smooth and convex. Beneath and the legs nitid, a transverse line across the abdominal segments close to the hind margin.

Long. 8 lines, lat. $2\frac{3}{4}$ lines.

96. *PÆCILUS LAEVIS*, MacI.

Mast. Cat. Col. Sp. 895.

97. *PÆCILUS CHLÆNIODES*, n.sp.

Resembling somewhat *P. resplendens*, Casteln. Black, nitid, thorax green, elytra semi-opaque greenish-black. Head rather small, a deep short impression on each side in front of the eyes immediately behind the clypeal suture and another punctiform one on each side of the clypeus, the labrum shorter than the clypeus, the antennæ and palpi picous. Thorax wider than the head, nearly square, rounded on the anterior angles, sides slightly round, posterior angles almost rectangular, the base wider a little than the apex, the median line lightly marked, the basal impressions short and deep, and a very small depression at the posterior angles. Elytra wider than the thorax and about four times the length, of oblong-oval form, finely striate, the striæ finely punctate, the interstices almost flat, the first stria from the suture short, about thrice the length of the scutellum. Legs rather long and slender, the hind thighs a little curved.

Long. $7\frac{1}{2}$ lines, lat. $2\frac{1}{2}$ lines.

98. *PÆCILUS SULCATULUS*, n.sp.

Black, nitid. Head smooth, the frontal impression deep and nearer the centre than in the other species. Thorax nearly square, wider than the head, the sides moderately rounded and thickly margined, the anterior angles very slightly produced, the posterior rectangular not acute, the base a little wider than the apex, the median line deeply marked, the basal impressions large, and a shallow fovea near the posterior angles. Elytra wider than the thorax and more than three times the length, strongly striate or grooved, the interstices smooth and convex, a few punctures

(2-4) on the second interstice from the suture on the middle third of its length, the scutellar stria punctate, about thrice the length of the scutellum and running out into the second stria. The under surface, legs and antennæ piceous.

Long. $7\frac{1}{2}$ lines, lat. $2\frac{3}{4}$ lines.

99. OMASEUS FROGGATTI, n.sp.

Black, nitid. Head sub-elongate, smooth, a short, curved deep impression on each side between the eyes. Thorax wider than the head and rather longer than wide, the sides rounded and narrowly margined, narrower at the base than at the apex, the posterior angles obtuse, the median line distinctly marked, and the basal impressions deep, narrow, and nearly one-third of the length of the thorax. Elytra very slightly oval, scarcely wider than the thorax and about three times the length, deeply striate on the four striæ nearest the suture, the interstices smooth and a little convex, scutellar stria wanting. Legs, antennæ, and under surface piceous.

Long. $6\frac{1}{2}$ lines, lat. $2\frac{1}{4}$ line.

100. RHYTISTERNUS ANGUSTULUS, n.sp.

Black, nitid, subdepressed. Head longer than wide, smooth, the frontal impressions well marked and diverging behind near the eyes, the antennæ and palpi piceous. Thorax wider than the head, slightly transverse, rounded a little on the sides, the base rectangular and of the width of the apex, the median line very lightly impressed, the basal impressions deep, narrow, and about one-fourth of the length of the thorax, with a small impression near each posterior angle. Elytra wider than the thorax and nearly three times the length, striate—the four striæ on each side of the suture, and two lateral rather strongly marked, the others almost obsolete, no short sutural stria. Under surface and legs dark piceous, the latter rather short and strong.

Long. 5 lines, lat. $1\frac{1}{2}$ line.

101. *RHYTISTERNUS LIMBATUS*, n.sp.

Of more robust form than the last, black or reddish-brown, nitid. Head as wide as long (labrum excluded), impressed as in the last, the antennæ and palpi piceous. Thorax wider than the head and nearly square, slightly rounded on the sides, the anterior angles subacute, the posterior nearly rectangular, the base and apex of equal width, the median line only impressed distinctly at the base, about the same length as the basal impressions, which are deep, the outer basal impressions strong and punctiform. Elytra a little wider than the thorax and more than twice the length, strongly striate on the first four and the lateral striæ, the others obsolete, the interstices slightly convex, no sutural stria, a wide more or less distinct yellowish border to the sides and apex of the elytra. Under surface piceous red, legs yellow, short and stout as in the last species.

Long. 4 lines, lat. $1\frac{1}{4}$ line.

102. *PTEROSTICHUS CRENULATUS*, n.sp.

Elongate-ovate, black, nitid. Head much longer than wide, smooth, the frontal impressions short not deep, formed of two impressions on each side scarcely united—one on the clypeus, the other immediately behind the clypeal suture; the antennæ piceous, filiform, the first four joints smooth, the rest pubescent, the last elongate-ovate. Thorax wider than the head, longer than wide, very nitid, the anterior angles slightly produced and sub-acute, the sides slightly rounded and distinctly margined, the base a little wider than the apex, with the posterior angles rounded, the median line lightly marked and the basal impressions broad, deep and punctate at the base. Elytra not wider than the thorax at its widest part, and three times the length, deeply striate, the striæ deeply punctured and narrow, the interstices raised and narrow, having a crenulated appearance from the small sharp punctures of the striæ, no short scutellar stria. Under surface and legs piceous, very nitid, the latter rather slender, the prosternum without margin, smooth.

Long. $4\frac{1}{4}$ lines, lat. $1\frac{1}{2}$ line.

103. *PTEROSTICHUS LÆVIGATUS*, n.sp.

Oblong-ovate, depressed, black, nitid, elytra slightly iridescent. Head as in the last species, antennæ slender, piceous. Thorax exactly as in *P. crenulatus*, the anterior angles being perhaps less acute, and the basal impressions rather more linear. Elytra wider than the thorax and nearly three times the length, striate, the striæ very minutely punctate, the interstices flat, no short scutellar stria. Legs piceous, moderately stout.

Long. 4 lines, lat. $1\frac{1}{8}$ line.

I have placed the last two species under the old sub-genus *Pterostichus*, because I have been unable to ascertain under which of the many sub-divisions of the genus *Feronia*, made by the late Baron de Chaudoir, they would come.

The *Feronides* of Australia are very numerous, and notwithstanding all that has been done by Count Castelnau, and Baron de Chaudoir, I know of no group more requiring careful revision.

104. *SIMODONTUS OCCIDENTALIS*, n.sp.

Oblong-ovate, subdepressed, black, very nitid, the elytra of a bronzy-black. Head scarcely longer than wide, smooth, the frontal impressions straight, linear, very slightly diverging behind and reaching to past the middle of the eyes, the antennæ short, piceous. Thorax transverse, much wider than the head, a little rounded on the sides, the base slightly wider than the apex, the posterior angles nearly square, the median line lightly marked except near the base, and the basal impressions short, deep, and minutely and rather rugosely punctate. Elytra a little wider than the thorax and more than twice the length, strongly striate, the interstices convex, a short stria at the base of the second interstice from the scutellum. Under surface and legs piceous, the latter short and moderately stout.

Long. 3 lines, lat. 1 line.

105. *ABACETUS FLAVIPES*, n.sp.

Oblong, black, nitid. Head smooth, a short impression on each side behind the clypeus, the antennæ piceous. Thorax wider than the head, and slightly longer than wide, much rounded on the sides, narrowed and rectangular at the basal angles, the median line strongly marked, the basal impressions deep, linear and almost half the length of the thorax. Elytra broader than the thorax and about twice the length, sub-convex, strongly striate, the interstices convex, no scutellar stria, the apex broadly tinged with piceous-red. Legs reddish-yellow.

Long. 2 lines, lat. $\frac{3}{4}$ line.

106. *ABACETUS QUADRATIPENNIS*, n.sp.

Of rather squarer form than the last species, the head more deeply impressed in front on each side, the thorax proportionately broader and more cordiform, the surface generally more nitid, and the legs dark piceous.

Long. $2\frac{1}{2}$ lines, lat. 1 line.

In addition to the *Carabidæ* above enumerated there are about 20 minute species apparently of the sub-families *Pogonides* and *Bembidiides*, which I am unable to identify at present; and 15 at least of others of various sub-families which I have left undetermined; these with the 17 species of *Olivina* previously omitted bring the total of *Carabidæ* in the collection to 150 species, an unusually large proportion of that family for Australia.

AUSTRALIAN INDIGENOUS PLANTS PROVIDING HUMAN FOODS AND FOOD-ADJUNCTS.

By J. H. MAIDEN, F.L.S., &c.

Hooker, in his "Flora of Tasmania," truly remarks that the products of many plants, although "eatable," are not "fit to eat," and would never be employed as food except in the direst necessity. Australian indigenous fruits, roots, leaves, and stems are nothing to boast of as eatables; and as in the greater part of this continent there is a very great scarcity, or even an entire absence, of water, an explorer can rarely traverse long distances without taking suitable food with him.

There is little doubt that most of those which are here recorded as having been utilised for food in other countries are also eaten by the omnivorous Australian aboriginal. Besides these, only those parts of certain plants have been referred to which have been recorded as having been used as food by aborigines and colonists. Extended observations must greatly augment the list.

Knowledge in regard to the indigenous vegetable food resources of these colonies should be considered an absolute necessity by those whose avocations take them out of beaten tracks, especially in the dry country; while the ordinary citizen may find himself occasionally in a position in which an acquaintance with the scanty vegetable food-products of the bush would be useful to him.

ABORIGINAL METHOD OF OBTAINING WATER.

We are indebted to the aborigines for a method of obtaining water, and that from a source in which we should perhaps least look for it. This simple method, which had best be given in the words of those who have had much intercourse with the blacks,

is now given, and no adult in Australia should be ignorant of it. There is no doubt that a knowledge of this method of obtaining water would have been the means of saving the lives of many people who have suffered one of the most terrible of all deaths—death from thirst.

“It frequently happens to the natives, when out in the mallee country, that the water-holes on which they had counted on obtaining a supply of water have dried up; but they are never at a loss. They select in the small broken plains some mallee trees, which are generally found surrounding them. The right kind of trees can always be recognised by the comparative density of their foliage. A circle a few inches deep is dug with a tomahawk around the base of the tree; the roots, which run horizontally, are soon discovered. They are divided from the tree and torn up, many of them being several feet in length. They are then cut into pieces, each about 9 inches long, and placed on end in a receiver, and good, clear, well-tasted water is obtained. The roots of several other trees yield water” (Dr. Grummow). This method of obtaining water in arid regions has been described in almost similar language by many explorers.

“How the natives existed in this parched country was the question! We saw that around many trees the roots had been taken up, and we found them without the bark and cut into short clubs or billets, but for what purpose we could not then discover. . . . I expressed my thirst and want of water. Looking as if they understood me, they hastened to resume their work, and I discovered that they dug up the roots for the sake of drinking the sap. It appeared that they first cut these roots into billets, and then stripped off the bark or rind, which they sometimes chew, after which, holding up the billet, and applying one end to the mouth, they let the juice drop into it.”—“Three Expeditions,” (Mitchell), pp. 196 and 199.

See also a paper by Mr. K. H. Bennett, *Proc. Linn. Soc. N.S.W.*, viii., 213.

See *Eucalyptus*, *Vitis*, *Hakea*.

ABORIGINAL BEVERAGES.

"The natives used also to compound liquors—perhaps after a slight fermentation to some extent intoxicating—from various flowers, from honey, from gums, and from a kind of manna. The liquor was usually prepared in the large wooden bowls (*tarnucks*) which were to be seen at every encampment. In the flowers of a dwarf species of *Banksia* (*B. ornata*) there is a good deal of honey, and this was got out of the flowers by immersing them in water. The water thus sweetened was greedily swallowed by the natives. The drink was named *Beal* by the natives of the west of Victoria, and was much esteemed (R. Brough Smyth, *Aborigines of Victoria*, i., 210)."

See *Banksia*, *Grevillea*, *Hakea*, *Lambertia*, *Telopea*.

Sir Thomas Mitchell (*Three Expeditions*, ii., 288,) speaking of an "Ironbark" near Port Phillip (Melbourne), says, the flowers are gathered, and by steeping them a night in water the natives make a sweet beverage called "bool" (evidently the same name as that in the preceding paragraph).

1. ACACIA ANEURA, *F.v.M.*, N.O. Leguminosæ, B.Fl., ii., 402.

"Mulga."

In western New South Wales two kinds of galls are commonly found on these trees; one kind is very plentiful, very astringent, and not used, but the other is less abundant, larger, succulent and edible. These latter galls are called "Mulga apples," and are said to be very welcome to the thirsty traveller.

Western Australia, through the other mainland colonies to Queensland.

2. ACACIA BIDWILLI, *Benth.*, N.O. Leguminosæ, B.Fl., ii., 420.

"Waneu" of the aborigines of Central Queensland. "Yadthor" of those of the Cloncurry River (Northern Queensland).

The roots of this tree are edible after baking (Thozet).

Queensland and Northern Australia.

3. *ACACIA CIBARIA*, *F.v.M.*, N.O. Leguminosæ, Muell. Cens., p. 46.

“Wonuy” of the natives about Shark’s Bay.

The natives use the seeds for food (Mueller and Forrest, *Plants indigenous around Shark’s Bay, W.A.*, 1883).

A quantity of these seeds obtained from near Milparinka, New South Wales, is in the Technological Museum. They are two or three times as large as most acacia seeds (resembling small castor-oil seeds somewhat), have an excessively hard and very thick coating, and what little nutritive matter they contain seems very liable to the attacks of an insect.

Western Australia and New South Wales.

4. *ACACIA LONGIFOLIA*, *Willd.*, var. *SOPHORÆ* (Syn. *A. Sophoræ*, R.Br.; *Mimosa Sophoræ*, Labill.), N.O. Leguminosæ, B.Fl., ii., 398.

It was the “Boobyalla” of the aborigines of Tasmania.

The natives of Tasmania used to roast the ripening pods of this wattle, pick out the seeds and eat them (Backhouse). It is believed that the seeds of other species of wattle were consumed in a similar manner.

Near the coast in all the colonies except Western Australia,

5. *ACÆNA SANGUISORBÆ*, *Vahl.*, (Syn. *A. sarmentosa*, Cormick) N.O. Rosaceæ, B.Fl., ii., 434.

A “Burr.”

The leaves of this plant have been used as a substitute for tea, and have been highly spoken of by some for this purpose.

All the colonies except Western Australia.

6. *ACHRAS AUSTRALIS*, *R.Br.*, (Syn. *Sapota australis*, A. DC.; *Sideroxylon australe*, Benth. & J. Hook., in Muell. Cens., p. 92), N.O. Sapotaceæ, B.Fl., iv., 282.

“Black Apple,” “Brush Apple,” “Wild” or “Native Plum” of colonists. Following are some aboriginal names:—“Jerra-wawah,” Illawarra and Brisbane Water (New South Wales), “Wy-caulie,” Richmond and Clarence Rivers (N.S.W.), “Tchoonboy,” Northern New South Wales and Southern Queensland.

The rich milky sap resembles cream in taste ; the fruit is like a very large plum, but of coarse, insipid flavour.

New South Wales and Queensland.

7. *ADANSONIA GREGORII*, *F.v.M.*, N.O. Malvaceæ, B.Fl., i., 223.

“Sour Gourd,” “Cream of Tartar” tree.

The dry acidulous pulp of the fruit is eaten. It has an agreeable taste, like cream of tartar, and is peculiarly refreshing in the sultry climates where the tree is found. It consists of gum, starch, sugary matter and malic acid (*Treasury of Botany*). A fine figure of this tree has just been published in Part 26 of the *Picturesque Atlas of Australasia*.

This species is hardly to be distinguished from the Baobab of Africa (*A. digitata*).

Northern and Western Australia.

8. *ADENANTHERA PAVONINA*, *Linn.*, N.O. Leguminosæ, B.Fl., ii., 298, and Muell. Cens., p. 43.

“Barricarri” of India, “False Jequirity.”

In India these seeds are occasionally used as an article of food. They are of the size of a kidney bean. They would doubtless require boiling, or some similar preparation, for it should be borne in mind that the Leguminosæ must be regarded as a poisonous Natural Order, in spite of the fact that it yields some of the most valuable foods used by man and beast.

Queensland.

9. *AGARICUS* (*PSALLIOTA*) *CAMPESTRIS*, *Linn.*, N.O. Fungi, Muell. Fragm. XI. Suppl., p. 79.

“The Common Mushroom.”

This and several other edible species of mushroom are found in Australia. Besides the present one, no mushroom perhaps is generally used in these colonies as food. Of course the dryness of the climate renders these edible fungi much less abundant than they otherwise would be.

All the colonies except Western Australia.

10. *ALEURITES MOLUCCANA*, Willd., (Syn. *A. Ambinux*, Pers. ; *A. triloba*, Forst. ; *Jatropha moluccana*, Linn.), N.O. Euphorbiaceæ, B.Fl. vi., 128. Noted in Muell. Cens. p. 20 as *A. triloba*.

"Candle-nut tree."

The natives of the countries in which this tree grows are very fond of this nut, which is similar in flavour to the common walnut and very wholesome. It is, however, rather rich, from the quantity of oil it contains.

Queensland.

11. *ALSOPHILA AUSTRALIS*, R.Br., (Syn. *A. excelsa*, R.Br. ; *A. Cooperi*, Hook. et Bak.), N.O. Filices, B.Fl. vii., 710 for *A. australis*, and 711 for *A. excelsa* and *A. Cooperi*. Bentham, however, expresses some doubts as to whether these may not be distinct species after all, and Baron Mueller (Cens. p. 137) records *A. australis* and *A. excelsa* as distinct species. Dr. Woolls further discusses the subject, *Proc. Linn. Soc. N.S.W.*, vi., 746.

"Tree fern." The aborigines of Illawarra (New South Wales) used to call it "Beeow-wang ; and the aborigines of Queensland, "Nanga-nanga." The aborigines of the Coranderrk Station, Victoria, call it "Pooeet."

The pulp of the top of the trunk is full of starch, and is eaten raw and roasted by the aborigines. This whitish substance is found in the middle of the tree from the base to the apex, and when boiled tastes like a bad turnip. Pigs feed on it greedily. (See also *Tasmanian Journal* for 1842, p. 35).

Tasmania, Victoria, New South Wales, and Queensland for *A. australis*; the two latter colonies for *A. excelsa*.

12. *AMARANTUS VIRIDIS*, *Linn.*, (Syn. *Euxolus viridis*, Moq.)
N.O. Amarantaceæ, B.Fl., v., 215. Bentham considers this may be introduced, and Mueller (Cens.) omits it.

This weed is a perfect nuisance in gardens and roadsides, but Mr. F. M. Bailey points out that besides being a fair substitute for cabbage, the leaves have been used externally with advantage as an emollient poultice. I have had this plant cooked, and I do not hesitate to pronounce it a valuable vegetable. It is an excellent substitute for spinach, being far superior to much of the leaves of the white beet sold for spinach in Sydney. Next to spinach it is most like boiled nettle-leaves, which when young are used in England, and are excellent. This *Amarantus* should be cooked like spinach, and as it becomes more widely known it is sure to be popular, except amongst persons who may consider it beneath their dignity to have anything to do with so common a weed.

All the colonies.

13. *ANGIOPTERIS EVECTA*, *Hoffm.*, N.O. Filices, B.Fl., vii., 694.

The aborigines used to feed on the pith of this tree-fern, which contains a certain amount of starch similar to sago (Foster).

This plant is not endemic in Australia.

Queensland.

14. *APIUM AUSTRALE*, *Thon.*, (Syn. *A. prostratum*, Labill.; *Petroselinium prostratum*, DC.; *Helosciadium australe*, Bunge; *H. prostratum*, Bunge); N.O. Umbelliferæ, B.Fl., iii., 372. *A. prostratum* in Muell. Cens., p. 63.

“Australian Celery.”

This plant may be utilized as a culinary vegetable (Mueller).

It is not endemic in Australia.

All the colonies.

15. *APONOGETON ELONGATUS*, *F.v.M.*, and *A. MONOSTACHYUS*.
Linn., N.O. Alismaceæ, B.Fl., vii., 188.

The tuberous roots of these water-plants are starchy, and of excellent taste, though not large (Mueller).

New South Wales, Queensland and Northern Australia (*A. elongatus*); Queensland and Northern Australia (*A. monostachyus*).

16. *ARAUCARIA BIDWILLII*, *Hooker*, N.O. Coniferæ, B.Fl. vi., 243.

“Bunya Bunya.”

The cones shed their seeds, which are two to two and a-half inches long by three-quarters of an inch broad; they are sweet before being perfectly ripe, and after that resemble roasted chestnuts in taste. They are plentiful once in three years, and when the ripening season arrives, which is generally in the month of January, the aborigines assemble in large numbers from a great distance around and feast upon them. Each tribe has its own particular set of trees, and of these each family has a certain number allotted, which are handed down from generation to generation with great exactness. The bunya is remarkable as being the only hereditary property which any of the aborigines are known to possess, and it is therefore protected by law. The food seems to have a fattening effect on the aborigines, and they eat large quantities of it after roasting it at a fire. Contrary to their usual habits, they sometimes store up the bunya nuts, hiding them in a water-hole for a month or two. Here they germinate, and become offensive to a white man's palate, but they are considered by the blacks to have acquired an improved flavour (Hill). Dr. Bennett mentions that after an indulgence in this exclusively vegetable diet they have an irresistible longing for flesh, and that in order to satisfy that craving, cannibalism used to be frequent amongst those tribes who were visitors (for the purpose of eating the bunya-bunya seeds) of those tribes in whose territory the bunya-bunya trees grow.

Queensland.

17. *ASTELIA ALPINA*, *R.Br.*, N.O. Liliaceæ, B.Fl., vii., 11.

The fruit is sweet, and the bases of the leaves are eaten (R. C. Gunn).

Tasmania, Victoria, and New South Wales.

18. *ASTROLOMA HUMIFUSUM*, *R.Br.*, (Syn. *A. pallidum*, Sond.; *Styphelia humifusa*, Pers.; *Ventenatia humifusa*, Cav.); and *A. PINIFOLIUM* (Syn. *Styphelia pinifolia*, Spreng.; *Stenanthera pinifolia*, R.Br.); N.O. Epacrideæ, B.Fl., iv., 156 and 159. *Styphelia humifusa* and *S. pinifolia* in Muell. Cens., p. 105.

Commonly called "Ground-berry." In Tasmania the fruits are often called "Native Cranberries."

The fruits of these dwarf shrubs are much appreciated by school-boys and aborigines. They have a viscid sweetish pulp, with a relatively large stone. The pulp is described by some as being "apple-flavoured," though I have always failed to make out any distinct flavour.

All the colonies except Queensland (*A. humifusum*); Tasmania, Victoria, and New South Wales (*A. pinifolium*).

19. *ATALANTIA GLAUCA*, *Hook.f.*, (Syn. *Triphasia glauca*, Lindl.), N.O. Rutaceæ, B.Fl., i., 370.

"Native Kumquat," "Desert Lemon."

The fruit is globular, and about half-an-inch in diameter. It produces an agreeable beverage from its acid juice. A fair preserve may be made out of the fruit.

New South Wales and Queensland.

20. *ATHEROSPERMA MOSCHATA*, *Labill.*, N.O. Monimiaceæ, B.Fl., v., 284.

"Sassafras."

The fragrant bark of this tree has been used as tea in Tasmania. A decoction or infusion of the green or dried bark was made, and

according to Mr. Gunn, it has a pleasant taste when taken with plenty of milk. Its effect is, however, slightly aperient.

It is also used in the form of a beer.

Tasmania, Victoria and New South Wales.

21. *ATRIPLEX CINEREA*, Poir., (Syn. *A. halimus*, R.Br., *A. elæagnoides*, Moq.), N.O. Chenopodiaceæ, B.Fl., v. 171.

Once used as a pot-herb in New South Wales.

During his overland journey to Port Essington, Leichhardt used a species of *Atriplex* as a vegetable, and spoke very highly of it.

All the colonies.

22. *AVICENNIA OFFICINALIS*, Linn., (Syn. *A. tomentosa*, Jacq.), N.O. Verbenaceæ, B.Fl., v. 69.

"Mangrove," "Egaie" of the Cleveland Bay aborigines, "Tagon-tagon" of the Rockhampton aborigines; "Baa-lunn" and "Tchoonchee" are other aboriginal names.

The fruit is heart-shaped, with two thick cotyledons. The aborigines of Cleveland Bay dig a hole in the ground, where they light a good fire; when well ignited, they throw stones over it, which when sufficiently heated, they arrange horizontally at the bottom, and lay on the top the *Egaie* fruit, sprinkling a little water over it; they cover it with bark, and over the whole, earth is placed to prevent the steam from evaporating too freely. During the time required for baking (about two hours), they dig another hole in the sand; the softened *Egaie* is put into it, they pour water twice over it, and the *Midamo* is now fit for eating. They resort to that sort of food during the wet season when precluded from searching for any other (Murrell's testimony,* quoted by Mons. Thozet).

In salt-water estuaries all round the coast.

*Murrell was a shipwrecked sailor, who lived for 17 years with the aborigines of Cleveland Bay, Queensland.

23. *BANKSIA* spp., N.O. Proteaceæ, B.Fl., v., 541.

“Honeysuckle.”

The name “honeysuckle” was applied to this genus by the early settlers, from the fact that the flowers, when in full bloom contain, in a greater or lesser quantity, a sweet honey-like liquid, which is secreted in considerable quantities (especially after a dewy night), and is eagerly sucked out by the aborigines. “It is so abundant in *B. ericifolia* and *B. collina* that when in flower the ground underneath large cultivated plants is said to be in a complete state of puddle; bees and wasps become intoxicated, and many lose their lives in it” (Smith, *Dictionary of Useful Plants*). This may possibly be true of a particular *Banksia* cultivated under exceptional conditions. But certainly it does not apply, except in a very modified degree, to the case of any *Banksia* I have noticed; and since I observed the above statement I have taken the trouble to look at hundreds of individuals of various species with the view to testing its accuracy. I have also requested Mr. Bäuerlen (a collector for the Technological Museum) to make similar observations, and he writes—“I have never heard from anyone having observed the liquid exuding so abundantly as mentioned by Smith. I have often found the flowers pretty rich in the honey-like liquid, and when travelling over dry, waterless areas I have sometimes sucked the liquid from the flowers to quench my thirst, but always endeavour not to do so, as it invariably gives me a headache, and a feeling of nausea afterwards.” See also *Grevillea*, *Hakea*, *Telopea*, *Lambertia* (all Proteaceous plants).

Throughout Australia.

24. *BILLARDIERA* SCANDENS, Smith, (Syn. *B. mutabilis*, Salisb.; *B. latifolia*, Putterl.; *B. grandiflora*, Putterl.; *B. angustifolia*, DC.; *B. canariensis*, Wendl.); N.O. Pittosporæ, B.Fl., i., 123.

“Apple Berry.”

The berries are acid and pleasant when fully ripe. From their shape children call them “dumplings.” When unripe, a small

quantity of the juice produces very disagreeable and persistent heartburn.

All the colonies except Western Australia.

25. *BOMBAX MALABARICUM*, DC., (Syn. *B. heptaphyllum*,^fCav.; *Salmalia Malabarica*, Schott); N.O. Malvaceæ, B.Fl., i., 223.

The "Simool" tree or "Malabar Silk-cotton" tree of India.

The calyx of the flower-bud is eaten as a vegetable in India (Brandis).

Queensland and Northern Australia.

26. *BOWENIA SPECTABILIS*, Hook., N.O. Cycadææ, B.Fl., vi., 254.

The yam-like rhizome is used largely for food by the natives (Bailey).

Queensland.

27. *BRASENIA PELTATA*, Pursh., (Syn. *Hydropeltis purpurea*, Mich.), N.O. Nymphæaceæ, B.Fl. i., 60; *Cabomba peltata*, F.v.M., Muell. Cens., p. 1.

This plant is considered nutritious in America, probably from the large-grained starch it contains.

Victoria, New South Wales and Queensland.

28. *BUCHANANIA ARBORESCENS*, Blume, (Syn. *Coniogeton arborescens*, R.Br.), N.O. Anacardiaceæ, Muell. Cens., p. 25.

The "Little Gooseberry" tree of Leichhardt.

"The unripe fruits of this plant were gathered, and, when boiled, imparted an agreeable acidity to the water, and when thus prepared, tasted tolerably well. When ripe they become sweet and pulpy, like gooseberries, although their rind is not very thick. This resemblance induced us to call the tree 'the little gooseberry' tree. It was much esteemed by the natives" (Leichhardt, *Overland Journey to Port Essington*, p. 479).

Queensland.

29. *CALADENIA* spp., N.O. Orchideæ, B.Fl., vi. 376.

"Spider Orchids."

These and other orchids have edible tubers.

Throughout Australia.

30. *CALOPHYLLUM INOPHYLLUM*, *Linn.*, N.O. Guttiferæ, B.Fl., i, 183.

The "Ndilo" of India.

During a debate on the Pearl Fisheries Bill in the Queensland Assembly, a clause was specially inserted to protect trees of this species at Thursday Island. A fine of £10 is inflicted on any person who cuts down or injures this or a cocoa-nut tree, or any other tree bearing edible fruit. This clause is, of course, mainly in the interest of the aboriginals.

Queensland.

31. *CANAVALIA OBTUSIFOLIA*, *DC.*, N.O. Leguminosæ, B.Fl., ii, 256.

The seeds are eaten by the blacks after cooking, as they are poisonous in the raw state. Some shipwrecked sailors in North-west Australia were poisoned by them (Forrest).

New South Wales, Queensland, Northern and Western Australia.

32. *CAPPARIS CANESCENS*, *Banks*, N.O. Capparideæ, B.Fl., i, 96.

"Native date." "Mondoleu" (diminutive of "Mondo," *C. Mitchellii*) of the aboriginals about Rockhampton.

The fruit is pyriform and half an inch in diameter. It is eaten by the aborigines without any preparation (Thozet). Mr. P. O'Shanesy observes that the pulpy part in which the seeds of these Australian species of *Capparis* are imbedded is a good substitute for mustard.

Queensland.

33. *CAPPARIS MITCHELLI*, *Lindl.*, (Syn. *Busbeckia Mitchellii*, F.v.M.), N.O. Capparideæ, B.Fl., i, 96.

"Small Native Pomegranate," "Native Orange," "Mondo" of the aborigines about Rockhampton (Queensland), "Karn-doo-thal" of the aborigines of the Cloncurry River, Northern Queensland.

The fruit is from one to two inches in diameter, and the pulp, which has an agreeable perfume, is eaten by the natives.

All the colonies except Tasmania and Western Australia.

34. *CAPPARIS NOBILIS*, *F.v.M.*, (Syn. *Busbeckia arborea*, *F.v.M.* ; *B. nobilis*, *Endl.*) ; N.O. Capparideæ, B.Fl., i., 95.

"Native Pomegranate," "Grey Plum," "Caper-tree," "Karum" of the aborigines about Rockhampton (Queensland).

The fruit, which is from one to two inches in diameter, is eaten by the natives.

New South Wales and Queensland.

35. *CARDAMINE HIRSUTA*, *Linn.*, (Syn. *C. parviflora*, *Hook.*; *C. debilis*, *Banks*; *C. paucijuga*, *Turcz.*), N.O. Cruciferae, B.Fl., i., 70.

Called "Lady's Smock" in England. It is a "cress."

This and other species afford excellent pot-herbs when luxuriant and flaccid. It is a common weed almost throughout the world.

Throughout the colonies.

36. *CARDIOSPERMUM HALICACABUM*, *Linn.*, N.O. Sapindaceæ, B.Fl., i., 453.

"Heartseed," "Heart-pea," "Winter-cherry," "Balloon Vine."

This common tropical weed is eaten as a vegetable in the Moluccas.

Queensland and Northern Australia.

37. *CAREYA ARBOREA*, *Roxb.*, (Syn. *C. australis*, *F.v.M.* ; *Barringtonia Careya*, *F.v.M.*), N.O. Myrtaceæ, B.Fl. iii., 289 (*C. australis* in *Muell. Cens.* p. 60).

Called "Broad-leaved Apple" tree. The "Barror" of the Rockhampton aborigines. Various called "Go-onje" and

"Gunthamarra" by the aborigines of the Cloncurry River (Northern Queensland), and "Ootcho" by the aborigines of the Mitchell River.

The Rev. J. E. Tenison-Woods records that the Queensland blacks eat the seeds, and he has heard it said that they roast and eat the fruit as well.

Queensland and Northern Australia.

38. *CARGILLIA AUSTRALIS*, *R.Br.*, (Syn. *Maba Cargillia*, F.v.M.; *Diospyros Cargillia*, F.v.M.), N.O. Ebenaceæ, B.Fl., iv., 288. *Diospyros Cargillia* in Muell. Cens., p. 92.

"Black Plum" (of Illawarra, New South Wales), "Booreerra" of some aborigines.

The fruits are of the size of a large plum, and of a dark purple colour. They are eaten by the aborigines.

New South Wales and Queensland.

39. *CARISSA OVATA*, *R.Br.*, (Syn. *C. Brownii*, F.v.M.), N.O. Apocynæ, B.Fl., iv., 305. *C. Brownii*, F.v.M., in Muell. Cens., p. 93.

"Native Scrub Lime," "Karey" of the aborigines of the Rockhampton tribe (Queensland), "Ulorin" of the aborigines of the Cleveland Bay tribe, "Kunkerberry" of the aborigines of the Cloncurry River (Northern Queensland).

This little bush produces a very pleasant fruit which is both agreeable and wholesome. It is like a sloe, egg-shaped, and about half-an-inch long. It exudes a viscid milky juice and contains a few woody seeds. "I can testify that the fruit is both agreeable and wholesome, and I never knew an instance of any evil consequences, even when they were partaken of most abundantly." (Tenison-Woods, *Proc. Linn. Soc. N.S.W.*, Vol. vii., 571).

South Australia, New South Wales and Queensland.

40. *CASSYTHA FILIFORMIS*, *Linn.*, (Syn. *C. guineensis*, Schum.), N.O. Laurineæ, B.Fl., v., 311.

This and other species of *Cassyltha* are called "Dodder-laurel." The emphatic name "Devil's guts" is largely used. It frequently connects bushes and trees by cords, and becomes a nuisance to the traveller.

This plant is used by the Brahmins of Southern India for seasoning their buttermilk (*Treasury of Botany*).

Queensland and Northern Australia.

41. *CASTANOSPERMUM AUSTRALE*, *A. Cunn.*, N.O. Leguminosæ, B.Fl., ii., 275.

"Moreton Bay Chesnut," "Bean-tree." Called "Irtalie" by the aborigines of the Richmond and Clarence Rivers (New South Wales), and "Bogum" by others of northern New South Wales.

Used as food by the aborigines, who prepare them by first steeping them in water from eight to ten days; they are then taken out, dried in the sun, roasted upon hot stones, pounded up into a coarse meal, in which state they may be kept for an indefinite period. When required for use, the meal is simply mixed with water, made into a thin cake, and baked in the usual manner. In taste, cakes prepared in this way resemble a coarse ship-biscuit (C. Moore).

A sample of starch from these seeds was exhibited by Mr. Moore at the Intercolonial Exhibition of Melbourne, 1866.

Northern New South Wales and Queensland.

42. *CASUARINA STRICTA*, *Ait.*, (Syn. *C. quadrivalvis*, Labill.; *C. macrocarpa*, *A. Cunn.*; *C. cristata*, Miq.; *C. Gunnii*, Hook. f.); N.O. Casuarinæ, B.Fl., vi., 195. *C. quadrivalvis* in Muell. Cens., p. 22.

"Shingle Oak," "Coast She-oak," "River Oak," "Salt-water Swamp Oak." The "Worgnal" of the aborigines of the Richmond and Clarence (New South Wales).

In cases of severe thirst, great relief may be obtained from chewing the foliage of this and other species, which, being of an

acid nature, produces a flow of saliva—a fact well-known to bushmen who have traversed waterless portions of the country. This acid is closely allied to citric acid, and may prove identical with it. Children chew the young cones, which they call “oak apples.”

All the colonies except Western Australia and Queensland.

43. *CHENOPODIUM AURICOMUM*, *Lindl.*, N.O. Chenopodiaceæ, B.Fl., v., 159.

One of the species called “Fat-hen.”

This is another of the salt-bushes, which, besides being invaluable food for stock, can be eaten by man. All plants of the Natural Order Chenopodiaceæ (Salsolaceæ), are more or less useful in this respect.

The following account of its practical utilization will be of interest.

“We have recently gathered an abundant harvest of leaves from two or three plants growing in our garden. These leaves were put into boiling water to bleach them, and they were then cooked as an ordinary dish of spinach, with this difference in favour of the new plant, that there was no occasion to take away the threads which are so disagreeable in chicory, sorrel, and ordinary spinach. We partook of this dish with relish—the flavour, analogous to spinach, had something in it more refined, less grassy in taste. The cultivation is easy—sow the seed in April (October) in a well-manured bed, for the plant is greedy; water it. The leaves may be gathered from the time the plant attains 50 centimètres (say 20 inches) in height. They grow up again quickly. In less than eight days afterwards another gathering may take place, and so on to the end of the year.” (*Journal de la Ferme et des Maisons de Compagne*, quoted in *Pharm. Journ.* [2] viii., 734.)

In all the colonies except Tasmania and Western Australia.

44. *CHENOPODIUM MURALE*, *Linn.*, (Syn. *C. erosum*, R.Br.), N.O. Chenopodiaceæ, B.Fl., v., 160. Bentham considers this may have been introduced, and Mueller (Cens.) omits it altogether.

"Australian Spinach," "Fat-hen." Other species share this name.

A pot-herb, which may be utilised in the same manner as the preceding species.

Southern colonies.

45. CITRIBATUS PAUCIFLORUS, *A. Cunn.*, (Syn. *Ixiosporum spinescens*, F.v.M.), N.O. Pittosporæ, B.Fl., i, 122.

"Native Orange," "Orange-thorn."

The fruit is an orange berry with a leathery skin, about one inch and a-half in diameter. The seeds are large. It is eaten by the aboriginals.

New South Wales, Queensland, and Northern Australia.

46. CITRUS AUSTRALIS, *Planch.*, (Syn. *Limonia australis*, *A. Cunn.*), N.O. Rutaceæ, B.Fl., i, 371. *Citrus Planchonii*, F.v.M., in Muell. Cens., p. 12.

"Native Lime," "Orange."

The fruit, which is an inch and a-half in diameter and almost globular, yields an agreeable beverage from its acid juice.

New South Wales and Queensland.

47. CLAYTONIA BALONENSIS (BALONNENSIS), *Lindl.*, (Syn. *Calandrinia Balonnensis*, F.v.M.), N.O. Portulacæ, B.Fl., i, 172.

Called "Periculia" by the aboriginals (Stuart).

This plant is eaten with bread by white people. The blacks also use it for food, mixed with baked bark (Annie F. Richards, in *Proc. R. S. S. A.*, iv. 136).

The seed is used for making a kind of bread, after the manner of that of *Portulaca oleracea* (Mueller, *Fragm.*, x, 71).

South Australia, New South Wales and Queensland.

48. CLAYTONIA POLYANDRA, *F.v.M.*, (Syn. *Talinum polyandrum*, *Hook.*), N.O. Portulacæ, B.Fl., i, 172.

“Coonda” of the aborigines about Shark’s Bay (Western Australia).

Used as food by some Western Australian tribes (Mueller and Forrest, *Plants indigenous about Shark’s Bay, W.A.*, 1883).

North and Western Australia, South Australia, and New South Wales.

49. *COCOS NUCIFERA*, Linn., N.O. Palmeæ, B.Fl., vii., 143.

“Cocoa-nut palm.”

This nut is so well-known that the following few notes concerning it will be sufficient:—As an article of food the kernel is of a great importance to the inhabitants of the tropics. In the Laccadives it forms the chief food, each person consuming four nuts per day, and the fluid, commonly called milk, which it contains, affords them an agreeable beverage. While young they yield a delicious substance resembling blanc-mange.

Among other products of this palm may be mentioned “toddy,” which when fermented is intoxicating; strong arrack is also distilled from it, besides which it yields vinegar and “jaggery” or sugar.

Queensland.

50. *COLOCASIA ANTIQUORUM*, Schott, (Syn. *Caladium acre*, R.Br.; *Arum Colocasia*, Linn.), N.O. Aroideæ, B.Fl., vii., 155.

The “Taro” of the Fijians.

This plant is cultivated in most tropical countries, Egypt, India, &c., for the sake of its leaves, which when uncooked are acrid, but by boiling, the water being changed, lose their acidity, and may be eaten as spinach (*Treasury of Botany*). Acid fruits are added to assist the removal of the acidity. Hindoos and Mahometans are very fond of all parts of the plants of this genus (Dymock).

When the crop is gathered in Fiji, says Dr. Seemann (*Flora Vitiensis*), the tops of the tubers are cut off and at once replanted. The young leaves may be eaten like spinach; but, like the root, they require to be well cooked in order to destroy the acidity

peculiar to aroideous plants. The Fijians prefer eating the cooked Taro when cold, Europeans as a rule like it quite hot, and, if possible, roasted. A considerable number of varieties are known, some better adapted for puddings, some for bread, or simply for boiling or baking. The outer marks of distinction chiefly rest upon the different tinge observable in the corm, leaf, stalks, and ribs of the leaves,—white, yellowish, purple.

The roots are also largely consumed for food in Japan, and in a descriptive Catalogue of the Japanese exhibits at the Health Exhibition, London, 1884, they are styled, “Japanese Potatos.”

Following is an analysis taken from the Catalogue :—

Albumen	1·427
Fat.....	0·080
Glucose.....	0·120
Starch	10·400
Pectose, &c.	1·154
Ash	0·987
Water	85·202

100.

Queensland.

51. COLOCASIA MACRORRHIZA, Schott, (Syn. *Caladium macrorrhizon*, R.Br.; *Alocasia macrorrhiza*, Schott), N.O. Aroideæ, B.Fl. vii., 155.

“Pitchu” of the aboriginals of the Burnet River (Queensland), “Cunjevoi” of those of South Queensland, “Hakkin” of the Rockhampton (Q.) aboriginals, “Banganga” or “Nargan” of the Cleveland Bay aboriginals.

The young bulbs, of a light rose-colour inside, found growing on large old rhizomes, are scraped by the aboriginals, divided into two parts, and put under hot ashes for about half an hour. When sufficiently baked they are then pounded by hard strokes between two stones—a large one, *Wallarie*, and a small one, *Kondola*. All the pieces which do not look farinaceous, but watery when broken,

are thrown away; the others, by strokes of the *Kondola*, are united by twos or threes, and put into the fire again; they are then taken out and pounded together in the form of a cake, which is again returned to the fire and carefully turned occasionally. This operation is repeated eight or ten times, and when the *Hakkin*, which is now of a green-greyish colour, begins to harden, it is fit for use (Thozet).

New South Wales and Queensland.

52. *COPROSMA HIRTELLA*, Labill., (Syn. *C. cuspidifolia*, DC.), N.O. Rubiaceæ, B.Fl., iii., 429.

Fruit sweet, eatable, not agreeable. The fruits of other species may be eaten also.

All the colonies except Queensland and Western Australia.

53. *COPROSMA BILLARDIERI*, Hook. f., (Syn. *C. microphylla*, ? Hook.; *Canthium quadrifidum*, Labill.; *Marquisia Billardieri*, A. Rich.); N.O. Rubiaceæ, B.Fl., iii., 430.

"Native Currant." "Morr" of the aboriginals of Coranderrk Station, Victoria.

This plant bears a small round drupe, about the size of a small pea. Mr. Backhouse states that (over half a century ago) when British fruits were scarce, it was made into puddings by some of the settlers of Tasmania, but the size and number of the seeds were objectionable.

New South Wales, Tasmania, and Victoria.

54. *CORDIA MYXA*, Linn., (Syn. *C. dichotoma*, Forst.; *C. Brownii*, DC.; *C. latifolia*, Roxb.; *C. ixiocarpa*, F.v.M.; *C. obliqua*, Willd.; *C. polygama*, Roxb.); N.O. Boragineæ, B.Fl., iv., 386.

The "Sebesten plum" of India.

In India the tender young fruit is eaten as a vegetable, and is pickled; the ripe fruit is eaten, and is greedily devoured by birds.

The kernel is eaten, and tastes somewhat like a filbert; that of the cultivated tree is better (Brandis).

Queensland.

55. *CORREA ALBA*, *Andr.*, (Syn. *C. cotinifolia*, Salisb.; *C. rufa*, Vent.; *Mazentoxeron rufum*, Labill.), N.O. Rutaceæ, B.Fl., i., 354.

Called "Cape Barren tea" in Tasmania, on account of its use near that headland.

The leaves of this plant have been used by the sealers on the islands in Bass' Straits as a substitute for tea.

Tasmania, South Australia, Victoria and New South Wales.

56. *CRINUM FLACCIDUM*, *Herb.*, (Syn. *Amaryllis australasica*, Ker; *A. australis*, Spreng.), N.O. Amaryllidæ, B.Fl., vi., 454.

The "Darling Lily."

This exceedingly handsome white-flowered plant, which grows back from the Darling, has bulbs which yield a fair arrowroot. On one occasion, near the town of Wilcannia, a man earned a handsome sum by making this substance when flour was all but unobtainable.

South Australia, Victoria, New South Wales and Queensland.

57. *CUCUMIS TRIGONUS*, *Roxb.*, (Syn. *C. pubescens*, Hook.; *C. jucundus*, F.v.M.; *C. picrocarpus*, F.v.M.), N.O. Cucurbitaceæ, B.Fl., iii., 317.

"Boomarrah" of the aborigines of the Cloncurry River, North Queensland.

Sir Thomas Mitchell, in one of his western trips, speaks of this plant growing in such abundance that the whole country seemed strewn with the fruit, which was then ripe, and of which the natives ate great quantities, and were very fond. It is about the size of a plum only.

In the *Treasury of Botany* it is observed that the tender tops of all the edible species of *Cucurbitaceæ*, boiled as greens or spinach, are even a more delicate vegetable than the fruit.

New South Wales, Queensland, Northern and Western Australia.

58. *CYATHEA MEDULLIS*, Swartz, N.O. Filices, B.Fl., vii., 708.

“Black-stemmed Tree-fern.”

The aborigines used to feed on the pith of this tree-fern, which contains a certain amount of starch similar to sago (Foster).

Tasmania, Victoria, and New South Wales.

59. *CYCAS MEDIA*, R.Br., N.O. Cycadeæ, B.Fl., vi., 249.

“Nut palm,” “Baveu” of Central Queensland aborigines.

Employed by the aborigines as food. An excellent farina is obtained from it. The nuts are deprived of their outer succulent cover (sarcocarp) and are then broken; and the kernels, having been roughly pounded, are dried three or four hours in the sun, then brought in a dilly-bag to a stream or pond, where they remain in the running water four or five days, and in stagnant water three or four days. By a touch of the fingers the proper degree of softness produced by maceration is ascertained. They are afterwards placed between the two stones mentioned under *Colocasia macrorrhiza*, reduced to a fine paste, and then baked under the ashes in the same way that our bush people bake their damper (Thozet).

Queensland and Northern Australia.

60. *CYMBIDIUM CANALICULATUM*, R.Br., N.O. Orchideæ, B.Fl., vi., 302.

The only orchid of the interior of tropical Australia which affords mucilaginous food (Mueller). The stems, &c., are eaten

South Australia, New South Wales, Queensland, and Northern Australia.

61. *CYTARIA GUNNII*, *Berk.*, N.O. Fungi, *Muell. Fragm.*, xi., 101 (Supp.).

This edible fungus is found on the branches of *Fagus Cunninghamii* or native Beech.

Tasmania.

62. *DENDROBIUM CANALICULATUM*, *R.Br.*, (Syn. *D. Tattonianum*, *Batem.*), N.O. Orchideæ, B.Fl., vi., 282.

"Yamberin" of the Queensland aborigines.

The bulbous stems, after being deprived of the old leaves, are edible (Thozet).

Queensland.

63. *DENDROBIUM SPECIOSUM*, *Smith*, N.O. Orchideæ, B.Fl., vi., 279.

"Rock-lily."

The large pseudo-bulbs have been eaten by the aborigines; they, however, contain but little nutritive matter.

Victoria, New South Wales, and Queensland.

64. *DICKSONIA ANTARCTICA*, *Labill.*, (Syn. *D. Billardieri*, F.v.M.; *Cybotium Billardieri*, R. C. Gunn in Tas. Journ. 1842), N.O. Filices, B.Fl., vii., 712. *D. Billardieri* in *Muell. Cens.*, p. 137.

The pulp of the top of the trunk is full of starch, and is eaten by the aborigines both raw and roasted.

"The native blacks of the colony used to split open about a foot and a-half of the top of the trunk, and take out the heart, in substance resembling a Swedish turnip, and of the thickness of a man's arm. This they also roasted in the ashes, and ate as bread; but it is too bitter and astringent to suit an English palate" (Gunn).

All the colonies except Western Australia.

65. *DIOSCOREA HASTIFOLIA*, *Endl.*, N.O. Dioscorideæ, B.Fl., vi., 461.

A "Yam."

One of the hardiest of the yams. The tubers are largely consumed by the local aborigines for food; it is the only plant on which they bestow any kind of cultivation, crude as it is (Mueller).

Western Australia.

66. *DIOSCOREA SATIVA*, *Linn.*, (Syn. *D. latifolia*, Benth.; *D. bulbifera*, Forst. ; *Helmia bulbifera*, Kunth), N.O. Dioscorideæ, B.Fl., vi., 461.

"Yam." "Karro" of the aborigines of the Mitchell River, North Queensland.

This yam is eaten by the aborigines of Australia, and in India it is cultivated almost everywhere as a vegetable. In *Watts' Dict.* the tubers are said to contain 23 per cent. of starch, and 68 per cent. of woody-fibre, gum, &c. In the same work, however, the tubers of *D. bulbifera* (merged in this species) are only credited with 10 per cent. of starch.

Queensland and Northern Australia.

67. *DIOSCOREA TRANSVERSA*, *R.Br.*, (Syn. *D. punctata*, R.Br.), N.O. Dioscorideæ, B.Fl., vi., 460.

"Long Yam." "Kowar" of the aborigines of Central Queensland.

The small young tubers are eaten by the aborigines without any preparation (Thozet).

New South Wales, Queensland, and Northern Australia.

68. *DODONÆA* spp. div., N.O. Sapindaceæ.

"Native Hops," on account of the capsules bearing some resemblance to hops, both in appearance and taste.

In the early days of settlement the fruits of these trees were extensively used, yeast and beer of excellent quality being

prepared from them. They are still so used to a small extent. *D. attenuata*, A. Cunn., in particular, was largely used in the Western District.

In times of drought cattle and sheep eat them.

Throughout the colonies.

69. *DIPLOGLOTTIS CUNNINGHAMII*, Hook. f., (Syn. *Cupania Cunninghamii*, Hook. f. ; *C. australis*, Hook. f. ; *Stadmannia australis*, Don) ; N.O. Sapindaceæ, B.Fl., i., 454.

"Tamarind Tree," "Burrunedura" of the aboriginals of Illawarra, and "Acouloby" and "Toonoum" of those of northern New South Wales.

This tree produces racemes of pleasant sub-acid fruit, used for preserves.

New South Wales and Southern Queensland.

70. *DRIMYS AROMATICA*, F.v.M., (Syn. *Tasmannia aromatica*, R.Br., N.O. Magnoliaceæ, B.Fl., i., 49.

"Pepper" tree.

The drupe is used as a condiment, being a fair substitute for pepper or rather allspice. The leaves and bark also have a hot, biting, cinnamon-like taste.

Tasmania, Victoria, and New South Wales.

71. *ELÆAGNUS LATIFOLIA*, Linn., (Syn. *E. conferta*, Roxb. ; *E. ferruginea*, A. Rich.), N.O. Elæagneæ, Muell. Cens., p. 64.

The fruit is eaten in India. It is acid and somewhat astringent. It makes good tarts (Beddome).

Queensland.

72. *ELÆOCARPUS BANCROFTII*, F.v.M. & Bail., N.O. Tiliaceæ, Proc. R.S. Queensland, 1885.

The cotyledons or "kernels" have a good flavour, and are eaten by the settlers. Other species of *Elæocarpus* have fruits which are more or less useful in this respect.

Johnstone River, Queensland

73. *ENTADA SCANDENS*, *Benth.*, (Syn. *E. Pursætha*, DC.; *Mimosa scandens*, Linn.), N.O. Leguminosæ, B.Fl., ii., 298. *E. Pursætha* in Muell. Cens., p. 43.

"Queensland Bean," "Barbaddah" of the Cleveland Bay aboriginals.

These large beans are eaten by the aboriginals. They are put into the stone oven and heated in the same way and for the same time as those of *Avicennia tomentosa* (q.v.); they are then pounded fine and put into a dilly-bag, and left for ten or twelve hours in water, when they are fit for use (*Murrell's testimony*). The natives of India also eat them after roasting and soaking in water. Queensland.

74. *ERYTHRINA INDICA*, *Lam.*, N.O. Leguminosæ, B.Fl., ii., 253.

"Indian Coral" tree.

In Ceylon the young tender leaves are eaten in curries. Queensland and Northern Australia.

75. *EUCALYPTUS CORYMBOSA*, *Smith.*, (Syn. *Metrosideros gummi-fera*, Soland.), N.O. Myrtaceæ, B.Fl., iii., 256.

"Bloodwood."

Archdeacon King has noticed Mellitose-manna on the leaves of this tree to a small extent when they are pierced by a beetle (*Anoplognathus cereus*).

New South Wales and Queensland.

76. *EUCALYPTUS DUMOSA*, *A. Cunn.* (a Mallee), B.Fl., iii., 230; *E. GRACILIS*, *F.v.M.* (a Mallee), B.Fl., iii., 211; *E. INCRASSATA*, *Labill.* (a Mallee), B.Fl., iii., 231; *E. MICROTHECA*, *F.v.M.* ("Bastard Box" or "Coolibah"), B.Fl., iii., 223; *E. OLEOSA*, *F.v.M.* (a Mallee), B.Fl. iii., 248, N.O. Myrtaceæ.

These Eucalypts, amongst others, yield water from their roots. See page 481. See also *Hakea leucoptera* and *Vitis* (*Cissus*).

Chiefly in the arid regions of the colonies.

77. *EUCALYPTUS DUMOSA*, *A.Cunn.*, N.O. Myrtaceæ, B.Fl., iii., 230.

Lerp, Larp, Laap, or Larap Eucalypt.

This shrub yields a kind of manna called Lerp or Larp by the aboriginals. It is the nidus of an insect, and consists of starch, which is eaten in summer by the aborigines of the mallee country. It somewhat resembles in appearance small shells; it is sweet, and in colour white or yellowish-white. According to Dr. Thomas Dobson, of Hobart, the insect which causes the lerp to form is *Psylla Eucalypti*.

It is probably formed on the leaves of other Mallee Eucalypts.

"This substance occurs on the leaves, and consists of white threads clotted together by a syrup proceeding from the insect (*Psylla Eucalypti*) which spins those threads. It contains, in round numbers, of water 14 parts, thread-like portion 33 parts, sugar 53 parts. The threads possess many of the characteristic properties of starch, from which, however, they are sharply distinguished by their form. When lerp is washed with water the sugar dissolves and the threads swell but slightly, but dissolve to a slight extent, so that the solution is coloured blue by iodine. The threads freed from sugar by washing consist of a substance called *Lerp-amylum*.

"Lerp-amylum is very slightly soluble in cold water, not perceptibly more so in water at 100°, but entirely soluble to a thin transparent liquid when heated to 135° in sealed tubes with 30 parts of water; this solution on cooling deposits the original substance in flocks, without forming a jelly at any time. The separation is almost complete.

"If the material employed in this experiment were entirely free from sugar, the liquid left after the separation of the flocks will also be free from sugar. The flocks deposited from solution are insoluble in boiling water, therefore lerp-amylum suffers no chemical change on being heated to 150° with water. Heated in the air-bath to 190° while dry, it turns brown, and is afterwards

merely reddened by solution of iodine; at the same time it becomes partly soluble in hot water; hence it appears that lerp-amylum undergoes a change similar to that which occurs when starch is converted into dextrin. By oxidation with nitric acid it yields oxalic acid, but no mucic acid; it is neutral to vegetable colours, and is not precipitated by lead acetate, and is therefore not to be confounded with the gums, &c.

"It gave by analysis 43.7 and 43.07 carbon, 6.6 and 6.4 hydrogen, agreeing with the formula $C_6 H_{10} O_5$ (44.4 C. and 6.2 H.). Like starch, lerp-amylum rotates the plane of polarisation to the right; and on digestion with dilute sulphuric acid, &c., forms a crystallisable carbo-hydrate which agrees in its properties with dextrin. It is insoluble in ammonia cuprate, and is homogeneous.

"Though the behaviour of lerp-amylum to iodine and to water, and its insolubility in cupr-ammonia distinguish it from cellulose, it is to be borne in mind that there are forms or conditions of cellulose which are blued by iodine and dissolve in water" (Flückiger in *Watts' Dict. vii., 2nd Suppl.* 733.)

Victoria and southern New South Wales.

78. *EUCALYPTUS DUMOSA*, *A. Cunn.* (for synonyms see B.Fl.), N.O. Myrtaceæ, B.Fl., iii., 230.

The "White Mallee" of South Australia. "Weir-Mallee" of aborigines, "Bunurduk" of the aborigines of Lake Hindmarsh Station, Victoria.

The blacks in South Australia powder the bark of the root of this and perhaps other Mallees, and eat it either alone, or mixed with portions of other plants. They call it "Congoo" (*Proc. R. S. S. A.*).

South Australia, Victoria and New South Wales.

79. *EUCALYPTUS GUNNII*, *Hook. f.*, (Syn. *E. ligustrina*, Miq.; *E. acervula*, *Hook. f.*), N.O. Myrtaceæ, B.Fl., iii., 246.

In Tasmania this is known as "Cider Gum," and in South-Eastern Australia occasionally as the "Sugar Gum." In the

same part it is known as "White Gum," "Swamp Gum," or "White Swamp Gum," and in the Noarlunga and Rapid Bay districts of South Australia as "Bastard White Gum." Occasionally it is known as "Yellow Gum." Near Bombala, New South Wales, two varieties go by the names of "Flooded or Bastard Gum," and "Red Gum."

The sweetish sap of this tree is often converted by settlers, (especially in Tasmania) into a kind of cider.

Tasmania, Victoria, and New South Wales.

80. *EUCALYPTUS RAVERETIANA*, *F.v.M.*, N.O. Myrtaceæ, *F.v.M.*,
Fragm. x., p. 99.

"Grey Gum," "Iron Gum," "Thozet's Box."

From cuts in the stem an acidulous, almost colourless liquid exudes in considerable quantity, in which respect this species resembles *E. Gunnii* (Mueller).

Queensland.

81. *EUCALYPTUS VIMINALIS*, *Labill.*, (Syn. *E. fabrorum*, Schlecht.,
and several other synonyms), N.O. Myrtaceæ, B.Fl., iii.,
239.

The "White Gum" or "Swamp Gum" of Tasmania. It is also called "Manna Gum." Other names are "Grey Gum," "Blue Gum," "Drooping Gum, &c."

From the bark of this tree, a kind of manna exudes. It is a crumbly white substance, of a very pleasant sweet taste, and in much request by the aborigines.

A white, nearly opaque manna from the normal *E. viminalis* was found by Mr. Bäuerlen at Monga, near Braidwood, New South Wales. It is in small pieces, about the size of peas, but of irregular, flattened shape. In appearance it very much resembles lime which has naturally crumbled or slaked by exposure to a moist atmosphere.

It is composed of an unfermentable sugar called *Eucalin*, which is peculiar to the sap of the Eucalypts, together with a fermentable sugar supposed to be *Dextroglucose*. The manna is derived from the exudation of the sap, which "drying in the hot parched air of the midsummer, leaves the sugary solid remains in a gradually increasing lump, which ultimately falls off, covering the ground in little irregular masses" (McCoy). This exudation of the sap is said by McCoy to take place from the boring of the "Great Black or Manna Cicada" (*C. mærens*).

The Hon. William Macleay of Sydney, is however, by no means of that opinion, as he thinks it cannot be doubted that the manna is the work of a gall-making *Coccus*.

The subject requires clearing up, and it is to be hoped that a naturalist will give his earnest attention to the matter.

South Australia, Tasmania, Victoria and New South Wales.

82. *EUCHEUMA SPECIOSUM*, *J. Agardh*, (Syn. *Gigartina speciosa*, Sond.), N.O. Algæ, Plate LXIV. Harvey's *Phycologia Australasica*.

"Jelly-plant" of Western Australia.

This is a remarkable sea-weed of a very gelatinous character which enters into the culinary arrangements of the people of Western Australia for making jelly, blanc-mange, &c. Size and cement can also be made from it. It is cast ashore from deep water.

Coast of Western Australia.

83. *EUGENIA JAMBOLANA*, *Lam.*, (Syn. *E. Moorei*, F.v.M.; *Syzygium Jambolanum*, DC.), N.O. Myrtaceæ, B.Fl. iii., 283. *E. Moorei* in Muell. Cens., p. 59.

"Durobbi" of the aborigines.

The fruit is much eaten by the natives of India; in appearance it resembles a damson, has a harsh but sweetish flavour, somewhat astringent and acid. It is much eaten by birds, and is a favourite food of the large bat or flying-fox (Brandis).

New South Wales and Queensland.

84. *EUGENIA MYRTIFOLIA*, Sims, (Syn. *E. australis*, Wendl.; *Jambosa australis*, DC.; *J. Thozetiana*, F.v.M.), N.O. Myrtaceæ, B.Fl., iii., 286.

"Brush cherry" or "Native myrtle."

The fruit is acid, and makes a good preserve.

"The red juice of the fruit of this tree is similar in its properties to that of red grapes. It contains free tartaric acid, cream of tartar, sugar, and a red colouring matter very sensitive to the action of acids and alkalies. By fermentation it yields wine possessing a bouquet. The colouring matter, which is soluble in alcohol and ether-alcohol but not in pure ether, is precipitated by lead-acetate, decolourised by reducing agents, and recovers its red colour on exposure to the air, just like litmus and the red colour of wine" (De Luca and Ubaldini, in *Watt's Dict.*, vi., 1st. Suppt., 608).

New South Wales and Queensland.

85. *EUGENIA SMITHII*, Poir., (Syn. *Acmena floribunda*, var. β , DC.; *A. elliptica*, Don; *Myrtus Smithii*, Spreng.; *Syzygium brachynemum*, F.v.M.); N.O. Myrtaceæ, B.Fl., iii., 283.

"Lilly-pilly." Called "Tdgerail" by the aboriginals of Illawarra, New South Wales, and "Coochin-coochin" by some Queensland aboriginals.

The fruits are eaten by the aboriginals, small boys, and birds. They are formed in profusion, are acidulous, and wholesome. They are white with a purplish tint, and up to 1 inch in diameter.

Victoria to Northern Australia.

86. *EUGENIA TIERNEYANA*, F.v.M., N.O. Myrtaceæ, B.Fl., iii., 284.

The fruit of this tree is used for jam-making by the settlers. It is produced in very large quantities.

Queensland.

87. *EUSTREPHUS LATIFOLIUS*, *R.Br.*, (Syn. *E. Brownii*, F.v.M.; *E. Watsonianus*, Miq.; *Luzuriaga latifolia*, Poir.), N.O. Liliaceæ, B.Fl., vii., 18. *E. Brownii* in Muell. Cens., p. 117.

This climber produces sweet though only small tubers, which however are probably capable of enlargement through culture (Mueller).

Victoria, New South Wales and Queensland.

88. *EXOCARPUS CUPRESSIFORMIS*, *R.Br.*, (Syn. *Leptomeria acerba*, Sieb. non R. Br.), N.O. Santalaceæ, B.Fl., vi., 229. *Exocarpos* in Muell. Cens.

"Native Cherry." "Tchimmi-dillen" of Queensland aboriginals. "Coo-yie" is another aboriginal name.

The fruit is edible. The nut is seated on the enlarged succulent pedicel. This is the poor little fruit of which so much has been written in English descriptions of the peculiarities of the Australian flora. It has been likened to a cherry with the stone outside (hence the vernacular name), by some imaginative person.

All the colonies.

89. *EXOCARPUS LATIFOLIA*, *R.Br.*, (Syn. *E. miniata*, Zipp.; *E. luzoniensis*, Presl.; *E. ovata*, Schnitzl.), N.O. Santalaceæ, B.Fl., vi., 228.

Broad-leaved "Native Cherry," "Scrub-sandalwood." "Oringorin" of the Queensland aboriginals, and "Ballat" of those of Gippsland.

The fruit is edible, being much the same as the preceding species.

This plant is not endemic in Australia.

Northern New South Wales to North Australia.

90. *FIGUS ASPERA*, *Forst.*, (Syn. *F. scabra*, *Forst.*), N.O. Urticeæ, B.Fl., vi., 174. *F. scabra* in *Muell. Cens.*, p. 22.

“Rough-leaved fig.” Called also “Purple fig” and “White fig.” “Noomaie” of the Rockhampton aborigines, “Balemo” of the Cleveland Bay (Queensland) aborigines.

This fruit, which is black when ripe, is eaten by the aborigines (Thozet). It is also eaten by colonists in the Clarence and Richmond River districts of New South Wales.

Victoria to Queensland.

91. *FIGUS GLOMERATA*, *Willd.*, (Syn. *F. vesca*, F.v.M.; *Covellia glomerata*, *Miq.*), N.O. Urticeæ, B.Fl., vi., 178.

“Clustered Fig” tree.

The fruit, which is of a light red colour when ripe, hangs in clusters along the trunk and on some of the highest branches and is used as food by the aborigines.

The ripe fruit is eaten, and is good either raw or stewed (Gamble, *Manual of Indian timbers*). Brandis, however, says, “In times of scarcity the unripe fruit is pounded, mixed with flour, and made into cakes.”

Queensland and Northern Australia.

92. *FIGUS PLATYPODA*, *A. Cunn.*, (Syn. *Urostigma platypodum*, *Miq.*), N.O. Urticeæ, B.Fl., vi. 169.

On his journey from Western Australia to the overland telegraph line, Mr. John Forrest, on more than one occasion, pronounced the fruit of this tree to be “very good.”

P. A. O'Shanesey (*Proc. Linn. Soc. N.S.W.*, vi., 736), however states that the fruit of this species is not edible. But the appetites of explorers frequently become voracious, and not too discriminating.

South Australia, Queensland, and Northern Australia.

93. *FUSANUS ACUMINATUS*, *R.Br.*, (Syn. *Santalum Preissianum*, Miq. ; *S. acuminatum*, A. DC.) ; N.O. Santalaceæ, B.Fl., vi., 215. *S. acuminatum* in Muell. Cens., p. 64.

“Quandong,” “Native Peach.”

The fleshy pericarp which envelops the seed known as the Quandong, makes an excellent subacid preserve and jelly. It is somewhat of the same flavour as the black guava. By simply extracting the stones and drying the fruit in the sun it may be dried and used when convenient, just like preserved apples.

The kernel is also edible, being very palatable. It is quite spherical.

All the colonies except Tasmania and Queensland.

94. *FUSANUS PERSICARIUS*, *F.v.M.*, (Syn. *Santalum persicarium*, *F.v.M.*), N.O. Santalaceæ, B.Fl., vi., 216.

“Native Sandalwood.”

The root-bark is used as a food by the aborigines (Hooker).

All the colonies except Tasmania and Queensland.

95. *GASTRODIA SESAMOIDES*, *R.Br.*, N.O. Orchideæ, B.Fl., vi., 309.

“Native potato” of parts of Tasmania.

The tubers were roasted and eaten by the Tasmanian natives. These tubers grow out of one another, and are of the size, and of nearly the form of kidney-potatoes ; the lowermost is attached by a bundle of thick fleshy fibres to the root of the tree from which it derives its nourishment. Mr. R. C. Gunn described the taste of them as somewhat resembling beetroot.

All the colonies except South and Western Australia.

96. *GAULTHERIA ANTIPODA*, var. *Forst.*, (Syn. *G. depressa*, Hook. f.), N.O. Ericaceæ, B.Fl., iv., 142.

The fruit is of superior flavour (Gunn).

Tasmania.

97. *GAULTHERIA HISPIDA*, *R.Br.*, N.O. Ericaceæ, B.Fl., iv., 141.

“Wax-cluster.”

The fruit is eatable. The flavour is difficult to describe, but it is not unpleasant. The late Mr. R. C. Gunn states that in tarts the taste is something like that of young gooseberries, with a slight degree of bitterness.

Tasmania, Victoria, and New South Wales.

98. *GEITONOPLESIMUM CYMOSUM*, *A. Cunn.*, (Syn. *G. montanum*, *A. Cunn.*; *G. asperum*, *A. Cunn.*; *G. angustifolium*, *A. Koch*; *Luzuriaga cymosa*, *R.Br.*; *L. montana*, *R.Br.*); N.O. Liliaceæ, B.Fl., vii., 19.

The young shoots offer a fair substitute for asparagus (O'Shanesy), and Baron Mueller suggests the culture of the plant with the view to its improvement.

Victoria, New South Wales, and Queensland.

99. *GERANIUM DISSECTUM*, *Linn.*, (Syn. *G. parviflorum*, *Willd.*; *G. pilosum*, *Forst.*; *G. philonothum*, *DC.*; *G. potentilloides*, *L'Hér.*; *G. australe*, *Nees*), N.O. Geraniaceæ, B.Fl. i., 296.

“Crow-foot.” Called “Native Carrot” in Tasmania.

The roots used to be eaten by the Tasmanian aboriginals, and doubtless by those of Australia. They used to roast them, for they are large and fleshy.

This plant is not endemic in Australia.

Throughout the colonies.

100. *GLEICHENIA DICHOTOMA*, *Hook.*, (Syn. *G. Hermannii*, *R.Br.*; *Polypodium dichotomum*, *Thunb.*; *Mertensia dichotoma*, *Willd.*), N.O. Filices, B.Fl., vii. 698. *G. Hermannii* in *Muell. Cens.*, p. 137.

The aboriginals have used the root of this fern for the purpose of extracting the starch for food.

This plant is not endemic in Australia.

New South Wales, Queensland, and Northern Australia.

101. *GRACILARIA CONFEROIDES*, var. *Grev.*, N.O. Algæ, Harvey's *Phycologia Australasica*.

This almost cosmopolitan sea-weed is used for making a jelly in Tasmania. For ordinary purposes it can be ranked in nutritive value with Irish or Caragheen Moss.

Tasmania and South Coast of Australia.

102. *GREVILLEA ANNULIFERA*, *F.v.M.*, N.O. Proteaceæ, B.Fl. v., 460.

The seeds are comparatively large, of almond taste, and the fruits are produced copiously. The shrub will live in absolute desert sands (Mueller).

Western Australia.

103. *GREVILLEA KENNEDYANA*, *F.v.M.*, N.O. Proteaceæ, Proc. R. S. Vict., 1887.

Many of the Grevilleas contain more or less honey, but this recently discovered one contains it the most abundantly, as far as I am aware. The flowers are exceedingly rich in a clear, sweet, honey-like liquid, which can be easily shaken out from the flowers and collected. Mr. Bäuerlen tells me that on account of this liquid the flowers are difficult to preserve.

See also *Banksia*.

Grey Ranges, New South Wales.

104. *GREWIA POLYGAMA*, *Roxb.*, (Syn. *G. helicterifolia*, Wall), N.O. Tiliaceæ, B.Fl., i., 271.

"Plain Currant," "Karoom," of aborigines of the Rockhampton tribe. "Ouraië," of aborigines of Cleveland Bay, and "Kooline," of those of the Cloncurry River.

"I found a great quantity of ripe *Grewia* seeds, and, on eating many of them, it struck me, that their slightly acidulous taste, if imparted to water, would make a very good drink; I therefore gathered as many as I could, and boiled them for about an hour;

the beverage which they produced was at all events the best we had tasted on our expedition ; and my companions were busy the whole afternoon in gathering and boiling the seeds" (Leichhardt, *Overland Expedition to Port Essington*, p. 295).

Queensland and Northern Australia.

105. *HAEMODORUM SPICATUM*, *R.Br.*, (Syn. *H. edule*, Endl.), and other species, N.O. *Amaryllideæ*, B.Fl., vi., 420.

The bulbs are eaten by the aborigines.

Western Australia.

106. *HAKEA LEUCOPTERA*, *R.Br.*, (Syn. *H. leucocephala*, Dietr.; *H. virgata*, *R.Br.*; *H. tephrosperma*, *R.Br.*; *H. longicuspis*, *R.Br.*; *H. stricta*, F.v.M.), N.O. *Proteaceæ*, B.Fl., v., 515.

"Needle bush," "Pin bush."

Good drinking-water is got from the fleshy-roots of this bush in the arid districts in which it grows. The same method of obtaining it is employed as described at page 481.

In an experiment on a water-yielding *Hakea*, the first root, about half an inch in diameter and six or eight feet long, yielded quickly, and in large drops, about a wine-glassful of really excellent water (Lockhart Morton, *Proc. R.S. Vict.*, 1860, p. 132.)

All the colonies except Tasmania and Western Australia.

107. *HAKEA LOREA*, *R.Br.*, (Syn. *Grevillea lorea*, *R.Br.*), N.O. *Proteaceæ*, B.Fl., v., 496.

"Cork-tree."

The *Proteaceæ* seem to be the most abundant yielders of honey amongst Australian plants. The flowers of the present species are very rich in a brown, thick, honey-like liquid, which sometimes is so abundant as to flow along and envelop the twigs. When pressing some flowers for herbarium specimens, Mr. B  uerlen found the liquid actually to run out between the papers. See also *Banksia*.

From New South Wales to Northern Australia.

108. *HELEOCHARIS* (*ELEOCHARIS*) *SPHACELATA*, *R.Br.*, (Syn. *H. plantaginea*, F.v.M.; *Scirpus sphacelatus*, Spreng.), N.O. Cyperaceæ, B.Fl., vii., 292.

“Kaya” of the aboriginals of Central Queensland.

This plant has small, almost spherical tubers,—six or twelve to each plant. They are eaten by the aborigines without any preparation (Thozet).

All the colonies except Western Australia.

109. *HIBISCUS HETEROPHYLLUS*, *Vent.*, (Syn. *H. grandiflorus*, Salisb.), N.O. Malvaceæ, B.Fl., i., 212.

“Queensland Sorrel,” and “Green Kurrajong.” It is the “Batham” of the aboriginals of Central Queensland. “Dtharang-gange” is a New South Wales aboriginal name.

The young shoots, leaves and roots are eaten by the aborigines without any preparation (Thozet).

New South Wales and Queensland.

110. *HIBISCUS TILIACEUS*, *Linn.*, (Syn. *Paritium tiliaceum*, St. Hil.), N.O. Malvaceæ, B.Fl., i., 218.

“Cotton Tree.” “Talwalpin” is an aboriginal name.

Forster says the bark is sucked in times of scarcity when bread-fruit fails in the South Sea Islands. It abounds in mucilage. The late M. Thozet says the aborigines of Central Queensland prize the root of this tree very much for food, and, in times of scarcity, eat the tops, which taste like sorrel.

New South Wales, Queensland and Northern Australia.

111. *HIRNEOLA AURICULA-JUDÆ*, *Fries*, (Syn. *Exidia auricula-Judæ*, Fries), N.O. Fungi, F.v.M. Fragam., xi. (Suppl.), 90.

This species is largely used in China as food. It is a common European species, growing chiefly on the elder, but also on the elm.

Victoria, Tasmania and New South Wales.

112. *HIRNEOLA POLYTRICHA*, *Fries*, N.O. Fungi, *Fragm.*, xi. (Suppl.), 90.

This is the common form in Port Jackson, and along the east coast. It is also found in New Zealand, where it became an article of export for the Chinese market. It is used to thicken soup (Tenison-Woods and Bailey, *Proc. Linn. Soc. N.S.W.*, v., 77).

South Australia, New South Wales and Queensland.

113. *HOVEA LONGIPES*, *Benth.*, (Syn. *H. leiocarpa*, *Benth.*), N.O. Leguminosæ, B.Fl., ii., 174.

Mr. P. A. O'Shanesy says that the young pods of this shrub are eaten by the Queensland aborigines.

New South Wales and Queensland.

114. *IPOMŒA* spp., N.O. Convolvulacæ.

"Native Yams."

The tubers of these plants are sometimes eaten by the aboriginals.

115. *LAGENARIA VULGARIS*, *Ser.*, N.O., Cucurbitacæ, B.Fl., iii., 316.

The fruit of this plant is purgative, and even poisonous, but after due preparation the aboriginals have been known to eat it, while some of the cultivated varieties seem to be eaten with impunity in various parts of the world.

At the Health Exhibition of 1884, held in London, the dried fruit from Japan was exhibited. The following particulars are taken from the catalogue of the Japanese exhibits. The method of manufacturing it is the following :—The first step is to cut off the extremities ; then the seeds and pulp are taken out. The fruit is then cut to a certain length, and is dried by hanging it on sticks. It will thus be preserved for a long period, if kept in proper

vessels and closed tightly. The method of cooking is by boiling with water, soy, sugar, mirin (sweet wine), &c. Following is an analysis:—

Albumen.....	8.322	Carbon.....	37.855	} Dry substances 79.65%
Extract by Petroleum		Nitrogen	1.310	
ether	1.544	Hydrogen.....	4.380	
Glucose.....	20.080	Oxygen	31.182	
Dextrin.....	15.410	Ash.....	4.920	
Non-nitrogenous sub-		Water.....	20.350	
stances and starch				
traces.....	18.688		99.997	
Cellulose.....	10.686			
Ash	4.920			
Water.....	20.390			
	<hr/>			
	100.040			

Queensland.

116. *LAMBERTIA FORMOSA*, *Smith*, (Syn. *Protea nectarina*, Wendl.), N.O. Proteaceæ, B.Fl., v., 415.

“Honey flower” or “Honeysuckle.”

This plant is as well-known to small boys about Sydney, as it is to birds and insects. It obtains its vernacular name on account of the large quantity of a clear honey-like liquid the flowers contain. After sucking some quantity the liquid generally produces nausea and headache. Sometimes it is so plentiful as to flow down the twigs. (See *Banksia*.)

New South Wales and Western Australia.

117. *LAVATERA PLEBEIA*, *Sims*, (Syn. *L. Behriana*, Schlect.; *Malva Behriana*, Schlect.; *M. Preissiana*, Miq.), N.O. Malvaceæ, B.Fl., i., 185.

“Tree mallow.”

In the early days of South Australia the roots of a white-flowering variety of this mallow were largely used by the natives for food. These roots were somewhat of the consistency of parsnips (Bailey).

All the colonies except Queensland.

118. *LEPTOMERIA ACIDA*, *R.Br.* ; *L. APHYLLA*, *R.Br.*, (Syn. *L. pungens*, F.v.M.) ; *L. BILLARDIERI*, *R.Br.*, (Syn. *Thesium drupaceum*, Labill.), N.O. Santalaceæ, B.Fl., vi., 222.

“Native Currants.”

The berries are edible, having a pleasant sub-acid flavour. They are useful to quench the thirst when in the bush, and are used for making jelly and preserve.

The fruits of *Leptomeria acida* have been examined chemically by Mr. (now Dr.) Rennie. Vide *Proc. Roy. Soc. N.S.W.*, p. 119, et seq.

Tasmania, New South Wales, and Queensland (*L. acida*) ; South Australia, Victoria, and New South Wales (*L. aphylla*) ; Tasmania, New South Wales, and Victoria (*L. Billardieri*).

119. *LEPTOSPERMUM SCOPARIUM*, *Forst.* (Syn. *L. floribundum*, Salisb. ; *L. recurvifolium*, Salisb. ; *L. juniperinum*, Smith ; *L. multiflorum*, Cav. ; *L. juniperifolium*, Cav. ; *L. squarrosus*, Sieb. ; *L. rubricaulis*, Link ; *L. styphelioides*, Schau. ; *L. aciculare*, Schau. ; *L. oxycedrus*, Schau. ; *L. baccatum*, Schau. ; *L. persiciflorum*, Reichb. ; *L. divaricatum*, Schau.), N.O. Myrtaceæ, B Fl., iii , 105.

“Tea tree.”

It is said that this is the shrub the leaves of which were utilised by the crews of Captain Cook's ships for the purpose of making “tea,” and that they were also used with spruce leaves in equal quantity for the purpose of correcting the astringency in brewing a beer from the latter. It is exceedingly common about Sydney, and large quantities would therefore be available to the sailors.

Species of this genus are exceedingly abundant not far from the coast, and the leaves would be very readily available, but the taste of the infusion made from them is too aromatic for the European palate.

All the colonies except Western Australia.

120. *LEUCOPOGON RICHEL*, *R.Br.*, (Syn. *L. parviflorus*, Lindl.; *L. polystachyus*, Lodd.; *L. lanceolatus*, Sieb.; *Styphelia Richei*, Labill.; *S. parviflora*, Andr.; *S. gnidium*, Vent.), N.O. Epacridæ, B.Fl., iv., 186. *Styphelia Richei*, in Muell. Cens., p. 105.

“Carrot-wood.”

The insignificant and barely edible berries of this shrub are said to have saved the life of the French botanist Riche, who was lost in the bush on the South Australian coast, for three days at the close of the last century.

All the colonies.

121. *LINUM MARGINALE*, *A. Cunn.*, (Syn. *L. angustifolium*, DC.), N.O. Lineæ, B.Fl. i., 283.

“Native flax.”

The mucilaginous seeds of this plant are eaten by the aborigines (Mueller). They are less than half the size of ordinary linseed, but possess all the properties of the latter. Towards the end of the summer large quantities of the seed may be obtained in many places.

Throughout the colonies.

122. *LISSANTHE MONTANA*, *R.Br.*, N.O. Epacridæ, B.Fl., iv., 176. United with *L. Hookeri*, Sond., under the name of *Styphelia montana*, F.v.M., in Muell. Cens., p. 106.

The white, transparent fleshy fruits of this species are edible. Tasmania, Victoria and New South Wales.

123. *LISSANTHE SAPIDA*, *R.Br.*; *Styphelia sapida*, F.v.M.; N.O. Epacridæ, B.Fl., iv., 175. *Styphelia sapida* in Muell. Cens., p. 105.

“Native Cranberry.”

The fruit is edible. It is something like the Cranberry of Europe both in size and colour, but its flesh is thin, and has been likened (*Treasury of Botany*) to that of the Siberian Crab.

New South Wales.

124. LISSANTHE STRIGOSA, *R.Br.*, (Syn. *L. subulata*, *R.Br.*; *L. intermedia*, *A. Cunn.*; *Styphelia strigosa*, *Smith*), N.O. Epacridæ, *B.Fl.*, iv., 175. *Styphelia strigosa* in *Muell. Cens.*, p. 105.

The berries are edible.

All the colonies except Western Australia.

125. LIVISTONA AUSTRALIS, *Mart.*, (Syn. *L. inermis*, *Wendl.*; *Corypha australis*, *R.Br.*), N.O. Palmæ, *B.Fl.*, vii., 147. *Muell. in Cens.*, p. 120, separates *L. inermis* from *L. australis*.

"Cabbage Tree," "Kondo" of the aborigines.

The aborigines are very fond of the growing centre or heart of this tree, which they eat in a raw or cooked state. But Baron Mueller says that the value of this esculent was not known to them in their uncivilized state.

"Several of my companions suffered by eating too much of the Cabbage-palm" (*Leichhardt, Overland Expedition to Port Essington*). At p. 41, he says, "the tops of the *Corypha* palm eat well, either baked in hot ashes or raw, and, though very indigestible, did not prove injurious to health when eaten in small quantities."

Victoria to Queensland.

126. MABA LAURINA, *R.Br.*, N.O. Ebenaceæ, *B.Fl.*, iv., 289.

This tree bears green, palm-like fruit, which is edible (*Kennedy*).

Queensland.

127. MACADAMIA TERNIFOLIA, *F.v.M.*, (Syn. *Helicia ternifolia*, *F.v.M.*), N.O. Proteaceæ, *B.Fl.*, v., 406.

"Queensland Nut." "Kindal-kindal" of the aborigines.

This tree bears an edible nut of excellent flavour, relished both by aborigines and Europeans. As it forms a nutritious article of

food to the former, timber-getters are not permitted to fell these trees. It is well worth extensive cultivation, for the nuts are always eagerly bought.

Northern New South Wales and Queensland.

128. *MACROZAMIA* spp., N.O. Cycadeæ, B.Fl., vi., 250. *Encephalartos* in Muell. Cens., p. 110.

The kernels of the nut, after being pounded, macerated and baked, are eaten by the natives. Curiously enough, the original occupants of the soil seem never to have made use of the copious starch, which can be readily washed out of the comminuted stems of any Cycadaceous plants. All these plants are pervaded by a virulent poison-principle, which becomes inert or expelled by heat (Mueller).

In all the colonies except Tasmania and Victoria.

129. *MACROZAMIA MIQUELII*, *F.v.M.*, (Syn. *Encephalartos Miquelii*, *F.v.M.*; *E. tridentatus*, Lehm.), N.O. Cycadeæ, B.Fl., vi., 253.

Dwarf Zamia. "Banga" of Central Queensland aborigines.

Found generally in the same locality as *Cycas media*, with a large cone fruit not unlike a pine-apple. The seeds, orange-red when ripe, and separating freely, are baked for about half-an-hour under ashes; the outside covers and stones are then broken, and the kernels, divided by a stroke of the *Kondola*, are put into a dilly-bag and carried to a stream or pond, where they remain six or eight days before they are fit for eating (Thozet).

Queensland.

130. *MACROZAMIA SPIRALIS*, *Miq.*, (Syn. *Zamia spiralis*, R.Br.; *Encephalartos spiralis*, Lehm.); N.O. Cycadaceæ, B.Fl., vi., 251. *Encephalartos spiralis* in Muell. Cens., p. 110.

"Burrawang nut," so called because they used to be, and are to some extent now, very common about Burrawang, N.S.W.

The nuts are relished by the aborigines. An arrowroot of very good quality is obtained from them.

New South Wales and Queensland.

131. *MARATTIA FRAXINEA*, *Smith*, (Syn. *M. salicina*, *Smith*), N.O. Filices, B.Fl., vii., 695.

The aborigines used to feed on the pith of this tree-fern, which contains a certain amount of starch similar to sago (Forster). The roots were used for a similar purpose.

This plant is not endemic in Australia.

New South Wales and Queensland.

132. *MARLEA VITIENSIS*, *Bentham*, (Syn. *Rhytidandra vitiensis*, *A. Gray*; *R. polyosmoides*, *F.v.M.*; *Pseudalangium polyosmoides*, *F.v.M.*); N.O. Cornaceæ, B.Fl., iii., 386. *Rhytidandra vitiensis* in *Muell. Cens.*, p. 74.

"Musk-tree."

The fruit is edible (P. O'Shanesy).

This plant is not endemic in Australia.

New South Wales and Queensland.

133. *MARSDENIA LEICHHARDTIANA*, *F.v.M.*, (Syn. *Leichhardtia australis*, *R.Br.*), N.O. Asclepiadaceæ, B.Fl., iv., 341.

"Doubah" or "Doobah" (aboriginal name for pods). It is the "Carcular" of the Central Australian aborigines.

The milky unripe fruits of this tree are eaten by the aborigines. In this state they are about the size of a large acorn, but more pointed at the ends. Sir Thomas Mitchell speaks of the aborigines as eating the fruits, seeds and all, but they were pronounced better roasted.

All the colonies except Tasmania.

134. *MARSILEA QUADRIFOLIA*, *Linn.*, N.O. Marsileaceæ, B.Fl., vii., 683 (where see synonymy).

"Clover-fern," "Nardoo."

In the summer months the swamps containing this plant dry up, and it withers completely away, but the spore cases remain. In former years (and even now in remote districts) the natives used to collect these, grind them between two stones, so as to make a kind of flour or meal, which they made into paste and used as an article of food.

Nardoo contains but little nutritive matter, and must be exceedingly difficult to digest.

Nevertheless the fruits of this plant (or perhaps *Sesbania aculeata*—see Bailey's remarks under that head) were the diet the Burke and Wills expedition were at one period reduced to. The following quotation from Wills' Journal is taken from Brough Smyth's *Aborigines of Victoria*:—"I cannot understand this nardoo at all; it certainly will not agree with me in any form. We are now reduced to it alone, and we manage to get from four to five pounds a day between us. . . . It seems to give us no nutriment. . . . Starvation on nardoo is by no means very unpleasant, but for the weakness one feels and the utter inability to move oneself, for, as far as appetite is concerned, it gives me the greatest satisfaction."

To Dr. Beckler is due the credit of having pointed out, first of all, when releasing Lyons and Macpherson from their perilous position, that the Marsilea fruit formed part of the food of some of the aboriginal inland tribes, the use of the plant having providentially been communicated to Lyons and his companion by the natives. Previously we were not aware of the economic utility of this kind of fern (Mueller, *Trans. R.S. Victoria*, 1862).

For full notes and physiological observations on the Nardoo Plant, *loc. cit.*

In Brough Smyth's *Aborigines of Victoria*, i., 383, will be found a drawing of these stones, such as are used by the natives of the Darling. The following description is given:—

"The slab, generally of sandstone, is about twenty-two inches* in length, fourteen inches in breadth, and about one inch in thickness. The handstones (*Wallong*) are round, or of an oval form, and vary in size. One is four inches and a-half in breadth, and one inch and three-quarters in thickness; and another is six inches in length, four inches and a-half in breadth, and three inches in thickness. The *Wallong* have hollows cut in them, so as to be more easily held by the hand.

"Mr. Howitt says that the stones here figured are like those usually seen at Cooper's Creek. In the flat stone there is a depression which leads out to the edge by a channel. In finding grass- or portulaca-seed, a little water is sprinkled in by the left hand, and the seeds being ground with the stone in the right hand form a kind of porridge, which runs out by the channel into a wooden bowl (*Peechee*), or a piece of bark. It may then be baked in the ashes, or eaten as it is, by using the crooked forefinger as a spoon. The term used for grinding seeds is *Bowardakoneh*.

"Nardoo seeds are pounded by the above, placing a few in at a time with the left hand. The "tap-tap" of the process may be heard in the camp far into the night at times."

All the colonies except Tasmania.

135. *MELODORUM LEICHHARDTII*, *Benth.*, (Syn. *Unona Leichhardtii*, F.v.M.), N.O. Anonaceæ, B.Fl., i. 52.

"Merangara" of the aborigines.

This tree has an oblong or almost round fruit, with one or two seeds. It is eaten by the aborigines without any preparation (Thozet).

Northern New South Wales and Queensland.

*In the Technological Museum is a very fine pair of stones from the Koringbirry Creek, 100 miles N.W. of Wilcannia, and 80 miles S. of Milparinka, N.S.W. The material is of fine-grained sandstone, inclining to quartzite. The dimensions of the bed-stone are 23×14 (widest part) $\times \frac{3}{4}$ to 2 inches, while those of the hand-stone are $5\frac{1}{2} \times 4 \times 1\frac{1}{4}$ inches. The handstone has no hollow cut in it, but it is well-worn, and it is of course impossible to say what its original thickness was.

136. *MESEMBRYANTHEMUM ÆQUILATERALE*, Haw., (Syn. *M. glaucescens*, Haw.; *M. Rossi*, Haw.; *M. nigrescens*, Haw.; *M. præcox*, F.v.M.); N.O. Ficoideæ, B.Fl., iii, 324.

"Pigs' faces." "Karkalla" of the Port Lincoln (S.A.) aborigines, "Katwort" of the East Gippsland aborigines, "Berudur" of those of the Lachlan River, New South Wales. It was the "Canajong" of the Tasmanian aboriginal.

The fleshy fruit is eaten raw by the aborigines. The leaves are eaten baked. Wilhelmi, in *Proc. R. S. Vict.*, 1860, gives an interesting account of the preparation of this substance for food by the Port Lincoln natives (S.A.) "Pressing the fruit (pigs' faces) between their fingers, they drop the luscious juice into their mouth. During the "Karkalla" season, which lasts from January to the end of summer, the natives leads a comparatively easy life; they are free from any anxiety of hunger, as the plant grows in all parts of the country, and most abundantly on the sandy hills near the sea. The men generally gather only as much as they want for the moment, but the women collect large quantities for eating after supper. The Port Lincoln blacks eat only the fruit of this plant, but those living between the Grampians and the Victorian ranges, as a substitute for salt with their meat, eat also the leaves of this saline plant."

All the colonies.

137. *MICROSERIS FORSTERI*, Hook., (Syn. *Scorzonera scapigera*, Forst.; *S. (Monermios) Lawrencii*, Hook. f.; *Phyllopappus lanceolatus*, Walp.), N.O. Compositæ, B.Fl. iii., 676.

"Murr-nong" or "Mirr n' yong" of the aborigines of New South Wales and Victoria.

The tubers were largely used as food by the aborigines. They are sweet and milky, and in flavour resemble the cocoanut.

All the colonies.

138. *MIMUSOPS BROWNIANA*, *Benth.*, (Syn. *M. Kauki*, R.Br.; *M. Kauki*, var. *Browniana*, A. DC.), N.O. Sapotaceæ, B.Fl., iv., 285.

The fruit is edible.
Queensland.

139. *MIMUSOPS PARVIFOLIA*, *R.Br.*, N.O. Sapotaceæ, B.Fl., iv., 284.

This tree yields a thick milky sap, which tastes like fresh cream (Hill).

Queensland and Northern Australia.

140. *MORINDA CITRIFOLIA*, *Linn.*, (Syn. *Sarcocephalus cordatus*, Miq.; *S. undulatus*, Miq.; *S. Leichhardtii*, F.v.M.; *Nauclea Leichhardtii*, F.v.M.; *N. coadunata*, Smith; *N. undulata*, Roxb.; *N. cordata*, Roxb.), N.O. Rubiaceæ, B.Fl., iii., 402 and 423; Muell. Cens., 74 and 75.

"Leichhardt's tree," "Canary Wood," "Indian Mulberry," "Oolpanje" of the aborigines of the Mitchell River, and "Coo-biaby" of those on the Cloncurry River, both in Northern Australia. It is the "Toka" of those of Rockhampton, and "Taberol" of those of Cleveland Bay.

It has a bitter-flavoured, granulated fruit, of which the natives are very fond (Thozet).

Queensland and Northern Australia.

141. *MUCUNA GIGANTEA*, *DC.*, N.O. Leguminosæ, B.Fl., ii., 254.

The seeds are eaten by the blacks after due preparation (Woolls).

This plant is not endemic in Australia.

Northern New South Wales, Queensland and Northern Australia.

142. *MUHLENBECKIA ADPRESSA*, *Meissn.*, var. *HASTIFOLIA* (Syn. *M. Gunnii*, Hook. f.; *Polygonum adpressum*, Hook. f.), N.O. Polygonaceæ, B.Fl., v., 274.

"Native Ivy," "Macquarie Harbour Vine or Grape" (of Tasmania).

The currant-like fruits are sub-acid, and were, and perhaps still are used for tarts, puddings and preserves; the leaves taste like sorrel.

All the colonies except Queensland.

143. MYLITTA AUSTRALIS, *Berk.*, (Syn. *Notihydnum australe*, F.v.M.), N.O. Fungi. Muell. Fragm., xi., 101.

“Truffles” or “Native Bread.”

This insipid underground fungus is generally met with by accident. When growing rapidly it sometimes causes the ground to crack, and may thus be discovered by a careful observer, as it probably was by the aborigines, who used it as food. It should be boiled, though cooking changes its character but little. It is said to taste like boiled rice.

“The largest I have seen is about the size of a child’s head, but a much larger one was dug up at Melbourne some months ago” (Woolfs, 1859).

It has a black skin which drops off in little fragments, enclosing a veined white mass, which at first is soft, and has a peculiar acid smell, but when dry becomes extremely hard and horny (*Treasury of Botany*). Mr. Brough Smyth likens its appearance to unbaked brown bread.

Backhouse states that the natives always informed him they obtained it from the neighbourhood of a rotten tree.

An interesting note on a specimen from Tasmania, by Mr. Wm. Southall, F.L.S., will be found in *Pharm. Journ.* [3], xv., 210, and a drawing of a section of a young plant is also given.

Victoria, New South Wales and Tasmania.

144. MYOPORUM DEBILE, *R.Br.*, (Syn. *M. diffusum*, *R.Br.*; *Pogonia debilis*, *Andr.*; *Andreusia debilis*, *Vent.*; *Capraria calycina*, *A. Gray*), N.O. Myoporineæ, B.Fl., v., 8.

“Amulla” of the aborigines.

The fruit, which is a quarter of an inch in diameter, is slightly bitter to the taste. It is eaten by the aborigines.

New South Wales and Queensland.

145. *MYOPORUM SERRATUM*, *R.Br.*, (Syn. *M. insulare*, *R.Br.*; *M. tasmanicum*, *A.DC.*), N.O. Myoporineæ, *B.Fl.*, v., 6.
M. insulare in Muell. Cens., p. 104.

"Blue-berry" tree, "Native Currant" tree, "Native Myrtle," "Native Juniper," "Cockatoo bush," "Palberry" of the aborigines of the Coorong, South Australia.

The berries are edible, though somewhat of a saltish and bitter flavour. They are much relished by birds.

All the colonies except Queensland.

146. *MYOPORUM PLATYCARPUM*, *R.Br.*, (Syn. *Disoon platycarpus*, *F.v.M.*), N.O. Myoporineæ, *B.Fl.*, v., 7.

"Sandalwood," "Dogwood."

The saccharine exudation or manna from this tree is of a dirty white colour with a pinkish tinge, and is eagerly sought after and eaten by the aborigines. It is exceedingly sweet, and very pleasant to the taste.

All the colonies except Tasmania and Queensland.

147. *MYRTUS ACMENIOIDES*, *F.v.M.*

"White Myrtle" of the Richmond and Clarence. "Lignum-vitæ."

And *MYRTUS FRAGRANTISSIMA*, *F.v.M.*, N.O. Myrtaceæ, *B.Fl.*, iii., 276-7.

The leaves of these two species are used for flavouring tea in Queensland (O'Shanesy).

New South Wales and Queensland.

148. *NASTURTIUM PALUSTRE*, *DC.*, (Syn. *N. terrestre*, *R.Br.*; *N. semipinnatifidum*, *Hook.*); N.O. Cruciferae, *B.Fl.*, i., 65.

Called "Native Cabbage" on the banks of the River Nepean (New South Wales).

This and other species afford excellent pot-herbs when luxuriant and flaccid (Hooker).

This plant is not endemic in Australia.

All the colonies except Western Australia.

149. *NELUMBIUM SPECIOSUM*, Willd., (Syn. *N. nucifera*, Gærtn.),
N.O. Nymphæaceæ, B.Fl., i., 62. *Nelumbo nucifera*, in
Muell. Cens., p. 1.

"Sacred Lotus," "Pink water-lily." "Aquaie" of the aborigines..

This plant was worshipped by the ancient Egyptians. It no longer is found on the Nile, but in many parts of Asia, and in India, China, and Japan it is still held sacred. In China, India, and North Australia the root, stock and seeds are used as food, while medicinal properties are assigned to the viscid juice of the leaf-stalks (*Treasury of Botany*).

The seeds are eaten raw, or roasted as coffee (Hooker).

Queensland and Northern Australia.

150. *NITRARIA SCHOBERI*, Linn., (Syn. *N. Billardieri*, DC.; *N. Olivieri*, Jaub. & Spach; *Zygophyllum australasicum*, Miq.),
N.O. Zygophyllæ, B.Fl., i. 291.

"Karambi" of Port Lincoln natives, South Australia.

It produces fruit of the size of an olive, of a red colour, and agreeable flavour. "When the weather is hot the natives lie at full length under a bush, and do not leave it until they have stripped it of its berries (Wilhelmi, *Proc. R. S. Vict.* 1860, p. 173).

This plant is not endemic in Australia.

All the colonies except Tasmania and Queensland.

151. *NYMPHÆA GIGANTEA*, Hook. (Syn. *N. stellata*, F.v.M.),
N.O. Nymphæaceæ, B.Fl., i., 61. *N. gigantea* and *N. stellata* are separated into two species, Muell. Cens., p. 1.

Blue Water-lily. "Yako Kalor" of the Rockhampton aborigines (Queensland), "Kaoroo" of those of Cleveland Bay; "Arnurna" of those of the Mitchell River.

The roots and fruit are eaten. The flower-stalks, too, may be eaten when young (Thozet).

New South Wales, Queensland, and Northern Australia.

152. *OCIMUM SANCTUM*, *Linn.*, (Syn. *O. anisodorum*, F.v.M.; *O. caryophyllum*, F.v.M.), N.O. Labiatae, B.Fl., v., 74.

"Mooda" of the aborigines of the Cloncurry River, North Queensland; "Bulla-bulla" of those of the Mitchell River.

The odour of the variety occurring in North Australia is similar to anise, while that of the East Australian variety resembles cloves. A pot herb.

Queensland and Northern Australia.

153. *ORYZA SATIVA*, *Linn.*, N.O. Gramineae, B.Fl., vii. 550.

"Rice." "Kineyah" of the aborigines of the Cloncurry River, North Queensland.

Baron Mueller found this plant to be truly indigenous in Australia. It is so well-known that it need not be dwelt upon here.

Northern Australia and Queensland.

154. *OWENIA ACIDULA*, *F.v.M.*, N.O. Meliaceae, B.Fl., i. 385.

"Sour plum," "Native peach or nectarine," "Emu apple." "Mooley apple" is a western New South Wales name. Aboriginal names are "Rancooran," "Warrongan," and "Gruie-Colaine."

The sub-acid fruit of this tree relieves thirst. It is eaten both by colonists and aborigines, and is of the size of a small nectarine.

South Australia, New South Wales, and Queensland.

155. *OWENIA CERASIFERA*, *F.v.M.*, N.O. Meliaceae, B.Fl., i., 386.

"Queensland plum," "Sweet plum," "Rose apple," "Rancooran."

This plant bears a fine juicy red fruit with a large stone. When fresh gathered it is very acid, but the Rev. J. E. Tenison-Woods states that on keeping, or better still, burying for a day or two in sand, it is both palatable and refreshing.

Queensland.

156. *OWENIA VENOSA*, *F.v.M.*, N.O., *Meliaceæ*, B.Fl., i., 386.

"Sour Plum," "Tulip Wood," "Mouliibie" of the aborigines of Southern Queensland; "Pyddharr" is another aboriginal name.

A beverage is produced by boiling the fruit, which, after going through certain processes, is denominated wine, and forms an agreeable beverage (Hill).

Queensland.

157. *OXALIS CORNICULATA*, *Linn.*, (Syn. *O. microphylla*, Poir. ; *O. perennans*, Haw. ; *O. Preissiana*, Steud. ; *O. cognata*, Steud.), N.O. *Geraniaceæ*, B.Fl., i., 301.

Called "Clover Sorrel" or "Sour-grass."

The acidulous leaves of this plant are eaten by the natives (Mueller).

Throughout the colonies.

158. *PANDANUS ODORATISSIMUS*, *Linn. f.*, (Syn. *P. spiralis*, R.Br.), N.O. *Pandaneæ*, B.Fl., vii., 148.

"Screw Pine."

"The natives at this season (September 16) seemed to live principally on the seeds of this plant, but they evidently require much preparation to destroy their deleterious properties. At the deserted camp of the natives which I visited yesterday, I saw half a cone of the *Pandanus* covered up in hot ashes, large vessels (*koolimans*) filled with water in which roasted seed-vessels were soaking, seed-vessels which had been soaked were roasting on the coals, and large quantities of them broken on stones and deprived of their seeds. This seems to show that, in preparing the fruit when ripe for use, it is first baked in hot ashes, then soaked in water to obtain the sweet substance contained between its fibres, after which it is put on the coals and roasted to render it brittle, when it is broken to obtain the kernels (Leichhardt, *Overland Journey to Port Essington*).

The lower yellow pulpy part of the drupes, and also the tender white base of the leaves, are eaten raw or boiled during times of scarcity in India (*Cyclop. of India*).

Northern Australia.

159. *PANDANUS PEDUNCULATUS*, *R.Br.*, N.O. Pandaneæ, B.Fl., vii., 149.

"Screw Pine," "Bread fruit." The "Wynnum" of Queensland aboriginals.

The kernels of the fruit are eagerly eaten by the aborigines, as are also the mucilaginous young parts of the leaves, &c.

New South Wales and Queensland.

160. *PANICUM DECOMPOSITUM*, *R.Br.*, (Syn. *P. lævinode*, Lindl. ; *P. proliferum*, F.v.M. ; *P. amabile*, Balansa), N.O. Gramineæ, B.Fl. vii., 489.

"Native Millet," "Umbrella grass." The seed used to be called "Cooly" by western New South Wales aboriginals, and "Tindil" by the aboriginals of Cloncurry River, North Queensland.

The grains pounded yield excellent food, although the grains are rather small.

This plant is not endemic in Australia.

All the colonies except Tasmania.

161. *PARINARIUM NONDA*, *F.v.M.*, N.O. Rosaceæ, B.Fl., ii., 426.

The "Nonda-tree" of N.E. Australia.

The aborigines use the esculent drupes as food. When ripe they taste somewhat like a mealy potato, with, however, a trace of that astringency so common to Australian fruits. They resemble in size and appearance a yellow egg-plum. Leichhardt, in his *Overland journey to Port Essington*, p. 315, describes the tree and its fruit, and also states that he found the fruit in the dilly-bags of the natives, and also abundantly in the stomachs of emus.

Queensland and Northern Australia.

162. *PERSOONIA* spp., N.O. Proteaceæ.

“Geebung.”

These fruits are mucilaginous, insipid, and slightly astringent. They are largely consumed by aboriginals, and also to some extent by small boys.

163. *PHASEOLUS MUNGO*, *Linn.*, (Syn. *P. Max*, *Linn.*), N.O. Leguminosæ, B.Fl., ii., 257.

“Komin” of the Rockhampton aboriginals, “Kadolo” of the Cleveland Bay aboriginals.

The roots of this pulse-plant are edible, and can be eaten after baking (Thozet). Doubtless they eat the seeds as well. It is commonly cultivated for its seeds in India and parts of Africa, where it is a common article of food. There are numerous cultivated varieties.

Queensland and Northern Australia.

164. *PHYSALIS MINIMA*, *Linn.*, (Syn. *P. parviflora*, R.Br.), N.O. Solanæ, B.Fl., iv., 466.

“Neen-gwan” of the aboriginals of the Cloncurry River, North Queensland.

The berries are eatable.

This plant is not endemic in Australia.

Another species is the well-known “Cape Gooseberry.”

New South Wales, Queensland, and Northern Australia.

165. *PICRIS HIERACIODES*, *Linn.*, (Syn. *P. barbarorum*, *Lindl.*; *P. angustifolia*, *DC.*; *P. attenuata*, *A. Cunn.*; *P. asperrima*, *Lindl.*; *P. hamulosa*, *Wall.*), N.O. Compositæ, B.Fl., iii., 678. (Not in *Muell. Cens.*).

Sir Thomas Mitchell, *Three Expeditions*, ii., 149, thus speaks of this plant:—“Near our camp we found some recent fire-places of the natives, from which they must have hastily escaped on our approach, for in the branches of a tree, they had left their net

bags containing the stalks of a vegetable that had apparently undergone some culinary process, which gave them the appearance of having been half boiled. Vegetables are thus cooked, I was told, by placing the root or plant between layers of hot embers, until it is heated and softened. The stalks found in the bag resembled those of the potato, and they could only be chewed, such food being neither nutritious nor palatable, for it tasted only of smoke."

This plant is not endemic in Australia.

All the colonies.

166. *PIPTURUS ARGENTEUS*, Wedd., (Syn. *P. propinquus*, Wedd.; *Urtica gigantea*, Forst.), N.O. Urticæ, B.Fl., vi., 185. *P. propinquus* in Muell. Cens., p. 22.

"Native Mulberry," "Kongangn," and "Coomeroo-coomeroo" of Queensland aboriginals.

The white berries are eaten by the aboriginals (Thozet).

This plant is not endemic in Australia.

New South Wales and Queensland.

167. *PITTOSPORUM PHILLYRÆOIDES*, DC., (Syn. *P. angustifolium*, Lodd.; and others), N.O. Pittosporæ, B.Fl., i., 112.

Called variously "Butter-bush," "Native Willow," and "Poison-berry" tree.

The seeds are very bitter to the taste, yet the aborigines in the interior were in the habit of pounding them into flour for use as food (Tepper).

In all the colonies except Tasmania.

168. *PODOCARPUS SPINULOSA*, R.Br., (Syn. *P. asplenifolia*, Labill.; *P. pungens*, Caley.; *Nageia spinulosa*, F.v.M.), N.O. Coniferae, B.Fl., vi. 247. *N. spinulosa* in Mull. Cens., p. 109. "Native Plum" or "Native Damson."

This shrub possesses edible fruit, something like a plum, hence its vernacular names. The Rev. Dr. Woolls tells me that, mixed with jam of the Native Currant (*Leptomeria acida*), it makes a very good pudding.

New South Wales.

169. *PORTULACA NAPIFORMIS*, *F.v.M.*, N.O. Portulacæ, B.Fl., i., 169.

The tubers of this plant are used by the natives for food.

Queensland and Northern Australia.

170. *PORTULACA OLERACEA*, *Linn.*, N.O. Portulacæ, B.Fl., i., 169.

"Pigweed" or "Purslane" (of England), "Thukouro" of the aboriginals of the Cloncurry River.

The seeds of this plant are largely used for food by the natives of the interior. One would suppose that so small a seed would scarcely repay the labour of collecting, but the natives obtain large quantities by pulling up the plant, throwing them in heaps, which after a few days they turn over, and an abundant supply of seed is found to have fallen out, and can be easily gathered up; the food prepared from this seed must be highly nutritious, for during the season that it lasts the natives get in splendid condition on it. The seeds are jet black and look like very fine gunpowder. The natives grind them in the usual mill (*i.e.*, a large flat-stone or bed-stone on which the seed is put, and a smaller one to be held in the hand for grinding), and of the flour they make a coarse paste.—See *Marsilea*.

"We had almost daily occasion to praise the value of the Purslane, which not only occurred in every part of the country explored, but also principally in the neighbourhood of rivers, often in the greatest abundance. We found it in sandy and grassy localities so agreeably acidulous as to use it for food without any preparation, and I have reason to attribute the continuance of our health partly to the constant use of this valuable plant. The absence of other antiscorbutic herbs in the north, and the facility with which it may be gathered, entitle it to particular notice." Baron Mueller's *Botanical Report of the North Australian Expedition* (quoted by Dr. Woolls).

All the colonies except Tasmania.

171. *PTERIS AQUILINA*, *Linn.*, var. *ESCULENTA*, *Hook.* (Syn. *P. esculenta*, *Forst.*), N.O. Filices, B.Fl., vii., 731.

“Brake-fern” or “Bracken.” Formerly called “Tara” by the aboriginals of Tasmania.

The aboriginals use the starchy rhizomes of this plant for food. They are eaten both raw and roasted. By crushing and washing the little starch they contain can easily be obtained.

In Tasmania this fern is often tall enough to conceal a man on horseback.

An interesting account of the economic value of this fern, by Mr. J. R. Jackson, will be found in the *Pharm. Journ.* [2], viii., 354.

In Japan the starch from this fern is called “Warabi,” and is obtained in the following manner:—In the season when the fern is withered, and no young shoot is to be seen, its root is collected, cut up into pieces, pounded, washed, decanted, and the settled starch is collected and dried. It is mixed with wheat, flour, or rice-meal and made into cakes, or when made into paste by boiling with water mixed with the astringent juice of the Japanese date-plum (*Diospyros Kaki*), it is used for joining paper together; the joint does not part though exposed to rain, hence it is widely used for this purpose (*Catal. of Japanese exhibits at the Health Exhibition, London, 1884*).

All the colonies.

172. *RHAGODIA PARABOLICA*, *R.Br.*, N.O. Chenopodiaceæ, B.Fl., v., 153.

A “Salt-bush.”

This bush yields, according to Mr. Stephenson, who accompanied Sir Thomas Mitchell in one of his expeditions, as much as 2 ozs. of salt by boiling 2 lbs. of leaves.

Travellers in the interior have found them exceedingly useful as vegetables. Sir Thomas Mitchell relates that after twice

boiling the leaves a few minutes in water to extract the salt, and then an hour in a third water, they formed a tender vegetable resembling spinach.

South Australia, New South Wales, and Queensland.

173. RHAMNUS VITIENSIS, *Benth.*, (Syn. *Dallachya vitiensis*, F.v.M.; *Colubrina vitiensis*, Seem.), N.O. Rhamneæ, B.Fl., i., 413. *Dallachya vitiensis*, in Muell. Cens., p. 60.

“Murtillam” of the aborigines.

The berries, which are a quarter of an inch in diameter, are edible.

Queensland.

174. RUBUS GUNNIANUS, *Hook.*, N.O. Rosaceæ, B.Fl., ii., 430.

This plant yields the best native fruit in Tasmania (R. C. Gunn), though perhaps that is not saying much.

Tasmania.

175. RUBUS ROSÆFOLIUS, *Smith.*, (Syn. *R. rosæflorus*, Roxb.; *R. eglanteria*, Tratt.; *R. pungens*, Cambess.; *R. Sikkimensis*, O. Kze.), N.O. Rosaceæ, B.Fl., ii., 431.

“Native Raspberry.” “Neram” of the aborigines.

Baron Mueller says, “This shrub bears in woody regions an abundance of fruits of large size, and these early and long in the season.”

The fruits of the Australian species of *Rubus* are for the most part insipid, with a mawkish, granular taste, and with a trace of astringency. They are encouraging to look at, but extremely disappointing to taste.

Victoria, New South Wales and Queensland.

176. SALICORNIA AUSTRALIS, *Soland.*, (Syn. *S. indica*, R.Br.), N.O. Chenopodiaceæ, B.Fl., v., 205.

The young shoots are pickled.

All the colonies.

177. *SAMBUCUS GAUDICHAUDIANA*, DC., and *S. XANTHOCARPA*, F.v.M. (Syn. *Tripetelus australasicus*, Lindl.), N.O. Caprifoliaceæ, B.Fl., iii., 398.

"Native Elderberry."

The fruit of these two native elders is fleshy and sweetish, and is used by the aborigines for food.

All the colonies except Western Australia (*S. Gaudichaudiana*); Victoria, New South Wales and Queensland (*S. xanthocarpa*).

178. *SANTALUM LANCEOLATUM*, R.Br., (Syn. *S. oblongatum*, R.Br.), N.O. Santalaceæ, B.Fl., vi., 214.

"Sandalwood" of the colonists. The "Tharra-gibberah" of the aborigines of the Cloncurry River, North Queensland.

This tree produces a small purple fruit of very agreeable taste. (Leichhardt's *Overland Journey to Port Essington*, p. 95).

All the colonies except Tasmania and Victoria.

179. *SCÆVOLA KÆNIGII*, Vahl, (Syn. *S. Taccada*, Roxb.; *S. sericea*, Forst.; *S. Lobelia*, DeVr.; *S. macrocalyx*, DeVr.; *S. chlorantha*, DeVr.; *S. Lambertiana*, DeVr.; *S. montana*, Labill.), N.O. Goodeniaceæ, B.Fl., iv., 86.

It sometimes goes under the name of "Native Cabbage."

A large succulent shrub often met with along the sandy beach. It has large rich green foliage, and a vegetable might be made out of it.

It is a common coast plant in the warmer parts of the world. Queensland and Northern Australia.

180. *SCHMIDELIA SERRATA*, DC., (Syn. *S. timoriensis*, DC.; *Ornitrophe serrata*, Roxb.; *Allophyllus ternatus*, Lour.), N.O., Sapindaceæ, B.Fl., i., 455. *Allophyllus ternatus*, in Muell. Cens., p. 24.

Its small red, ripe berries are eaten in India (*Cyclop. of India*). Queensland and Northern Australia.

181. *SEMECARPUS ANACARDIUM*, *Linn.*, (Syn. *S. australasicus*, Engl.), N.O. Anacardiaceæ, B.Fl., i., 491.

“Marking-nut” tree of India.

The thick fleshy receptacle bearing the fruit is of a yellow colour when ripe, and is roasted and eaten by the natives of India. The seeds, called Malacca-beans or Marsh nuts, are eaten (*Treasury of Botany*).

The Portuguese at Goa salt the green fruit and use them like olives (Dymock).

When fresh the fruit is dry and astringent—roasted, it is said to taste somewhat like roasted apples, and when dry somewhat like dates (Brandis).

Queensland and Northern Australia.

182. *SESBANIA ACULEATA*, *Pers.*, (Syn. *S. australis*, F.v.M.), N.O. Leguminosæ, B.Fl. ii., 213.

The “Nardoo” of the aboriginals of the Norman River, Queensland.

The natives of Northern Queensland make, or used to make, a bread of the seeds of this species—(See *Marsilea quadrifolia*).

“In North Queensland, according to Mr. T. A. Gulliver, the natives make bread of the seeds of *Sesbania aculeata*, Pers. I am of opinion that this is the true Nardoo of the Cooper’s Creek natives. The unfortunate explorers (Burke and Wills) might easily have mistaken the spore cases of a *Marsilea* for the shelled-out seeds of *Sesbania*” (Bailey, in *Proc. Linn. Soc. N.S.W.*, 1880, p. 8).

South Australia, New South Wales, Queensland, Northern and Western Australia.

183. *SOLANUM AVICULARE*, *Forst.*, (Syn. *S. vescum*, F.v.M.; *S. laciniatum*, Ait.; *S. reclinatum*, L’Hér.), N.O. Solanææ, B.Fl., iv., 448. In Muell. Cens., p. 95 6, *S. aviculare* and *S. vescum* are made separate species.

"Kangaroo apple," "Gonyang" or "Koonyang" of the Gippsland and other aboriginals. "Meakitch" or "Mayakitch" or "Mookich" of the aboriginals of Western Victoria (Lake Condah).

Its large fruit resembles that of the potato. The fruit when perfectly ripe, which is indicated by the outer skin bursting, may be eaten in its natural state, or boiled and baked. It has a mealy, subacid taste, and may be eaten in any quantity with impunity; but until the skin bursts, although the fruit may otherwise appear ripe, it has an acrid taste, and causes an unpleasant burning sensation in the throat (Gunn).

All the colonies except Western Australia and Queensland.

184. *SOLANUM ESURIALE*, *Lindl.*, (Syn. *S. pulchellum*, F.v.M.), N.O. Solanæ. B.Fl. iv., 454.

"Comyn" of the aboriginals of the Lachlan River, New South Wales. "Oon-doroo" of those of the Cloncurry River, North Queensland.

The berries of this plant were eaten by the native guides of Sir Thomas Mitchell (*Three Expeditions*, ii., 43).

All the colonies except Tasmania and Western Australia.

185. *SOLANUM HYSTRIX*, *R.Br.*, N.O. Solanæ, B.Fl., iv., 458.

Called "Walga" by aborigines in South Australia.

The blacks use the fruit for food, but only with the pounded and baked bark of the mallee root, called "Congoo" by them. Before using the fruit they take off the shell (the dry prickly calyx), and remove the seeds. This leaves a pulpy skin about the thickness of that of a native peach (? *Owenia*); the fruit and bark are then made into a cake. When fruits are not obtainable, and they are otherwise hard pressed for food, the natives bleed themselves in the arm, and use the blood with the bark. The natives told me, when opening the fruit for the seeds, not to eat the fruit, as it would make my throat sore, nor yet to touch my eyes with my fingers. The fine prickles and juice got into my fingers, and produced a good deal of pain and inflammation for a short time. (Annie F. Richards, in *Proc. R.S. S.A.*, iv., 136).

South Australia.

186. *SOLANUM SIMILE*, *F.v.M.*, (Syn. *S. laciniatum*, var. R.Br., *S. fasciculatum*, F.v.M.), N.O. Solanææ, B.Fl., iv., 448.

Called "Quena" by aborigines in South Australia.

The blacks are fond of the fruit, but do not eat it until it has fallen to the ground. Both black and white men agree that to eat many will cause sickness. The fruit causes a hot burning taste in the mouth, but its scent reminds me of that of strawberries. (Annie F. Richards, *Proc. R.S. S.A.*, iv., 136).

All the colonies except Tasmania and Queensland.

187. *SONCHUS OLERACEUS*, *Linn.*, (Syn. *S. asper*, Fuchs; *S. ciliatus*, Lam.; *S. fallax*, Wallr.), N.O. Compositæ, B.Fl., iii., 679. {The genus *Sonchus* is omitted from Muell. Cens.

Commonly called "Sow-thistle." It is the "Thalaak" of the East Gippsland aborigines.

The stems and roots are eaten (Hooker).

Leichhardt, in his *Overland Journey to Port Essington*, says that the young shoots of *Sonchus* made an excellent vegetable.

This plan is not endemic in Australia.

Throughout the colonies.

188. *STERCULIA DIVERSIFOLIA*, *G. Don*, (Syn. *Brachychiton populneum*, R.Br.; *Pæcilodermis populnea*, Schott), N.O. Sterculiaceæ, B.Fl., i., 229. *Brachychiton populneum* in Muell. Cens., p. 15.

"Black Kurrajong." The "Bottle-tree" of Victoria.

The tap-roots of young trees, and the young roots of old trees, are used as food by the aborigines (Macarthur). When boiled they have a flavour similar to that of turnips, but sweeter.

The seeds of this and other species are edible, and make a good beverage.

Victoria, New South Wales and Queensland.

189. *STERCULIA QUADRIFIDA*, *R.Br.*, N.O. Sterculiaceæ, B.Fl., i., 227.

A "Kurrajong." "Calool" of the aborigines of northern New South Wales. "Convavola" is another aboriginal name.

The black seeds taste like filberts. As many as eleven of the brilliant scarlet fruits may be seen in a cluster, and each of them may contain up to ten or eleven seeds (Mueller). The mucilaginous substance of the unripe food is also edible (Thozet).

Northern New South Wales, Queensland and Northern Australia.

190. *STERCULIA RUPESTRIS*, *Benth.*, (Syn. *Delabechea rupestris*, Lindl.; *Brachychiton Delabechii*, F.v.M.); N.O. Sterculiaceæ, B.Fl., i., 230. Noted as *Brachychiton Delabechii*, in Muell. Cens., p. 15.

A "Kurrajong." The "Bottle-tree" of N. E. Australia, and also called "Gouty stem" on account of the extraordinary shape of the trunk. It is the "Binkey" of the aboriginals.

The stem abounds in a mucilaginous or gummy substance resembling pure tragacanth, which is wholesome and nutritious, and is said to be used as an article of food by the aborigines in cases of extreme need. A similar clear jelly is obtainable by pouring boiling water on chips of the wood.

"It is said that the soft juicy tissue of the stem can be eaten, and that many a wanderer in the bush has staved off hunger by its means. The young shoots and roots of young trees are agreeable and refreshing. The nuts also are eaten" (Thozet, also Tenison-Woods, *Proc. Linn. Soc. N.S.W.*, Vol. vii., p. 573).

Thozet speaks of the natives cutting holes in the soft trunk, where the water lodges, and rots the trunk to its centre. These trunks are so many artificial reservoirs of water. When a tree has been cut its resources are not exhausted. The tired hunter, when he sees a tree that has been tapped, cuts a hole somewhat lower than the old cuts, and obtains an abundant supply of the sweet mucilaginous juice afforded by the tree.

Queensland.

191. *STERCULIA TRICHOSIPHON*, *Benth.*, (Syn. *Trichosiphon australe*, Schott; *Brachychiton platanoides*, R.Br.), N.O. Sterculiaceæ, B.Fl., i., 229. *Brachychiton platanoides* in Muell. Cens., p. 15.

“Ketey” of the aborigines.

The roots of young plants are eaten by the aborigines without any preparation (Thozet).

Queensland and Northern Australia.

192. *STYPHELIA ADSCENDENS*, *R.Br.*, N.O. Epacrideæ, B.Fl., iv., 146.

The fruit is eatable.

South Australia, Victoria, New South Wales, and Tasmania.

193. *STYPHELIA TRIFLORA*, *Andr.*, (Syn. *S. glaucescens*, Sieb.), N.O. Epacrideæ, B.Fl., iv., 147.

“Five Corners.”

These fruits have a sweetish pulp with a large stone. They form part of the food of the aborigines, and are much appreciated by schoolboys. When from a robust plant they are of the size of a large pea, and not at all bad eating.

New South Wales and Queensland.

194. *SUÆDA MARITIMA*, *Dumort.*, (Syn. *S. australis*, Moq.; *Chenopodina maritima*, Moq.; *C. australis*, Moq.; *Chenopodium australe*, R.Br.), N.O. Chenopodiaceæ, B.Fl., v., 206.

The fleshy leaves of this plant can be utilised for pickling (Woolls).

It is common on the sea-coasts of most temperate and sub-tropical regions of the world.

Throughout the colonies.

195. *TACCA PINNATIFIDA*, *Forst.*, N.O. Taccaceæ, B.Fl., vi., 458.

The root is very bitter when raw, but yields a great quantity of white fecula, of which good flour for confectionery is made. The fecula much resembles arrowroot, and is very nutritive.

In Arracan the starch is, or was, extracted for the China market (*Pharm. Journ.*, vi., 383.)

Queensland and Northern Australia.

196. *TELOPEA SPECIOSISSIMA*, *R.Br.*, (Syn. *Embothrium speciosissimum*, Smith; *E. spathulatum*, Cav.; *E. speciosa*, Salisb.; *Hylogyne speciosa*, Knight), N.O. Proteaceæ, B.Fl., v. 534.

“Waratah” or “Native Tulip.”

So early as 1803 it was observed (*Curtis's Bot. Mag.*) that the natives make an agreeable repast by sucking the tubular flowers, which abound in honey. See “*Banksia*.”

New South Wales.

197. *TERMINALIA* sp., N.O. Combretaceæ.

“We collected a great quantity of *Terminalia* gum, and prepared it in different ways to render it more palatable. The natives, whose tracks we saw everywhere in the scrub, with frequent marks where they had collected gum, seemed to roast it. It dissolved with difficulty in water; added to gelatine soup it was a great improvement. . . . But it acted as a good lenient purgative on all of us” (*Leichhardt, Overland Journey to Port Essington*, p. 374).

198. *TERMINALIA CATAPPA*, *Linn.*, N.O. Combretaceæ, Muell. Cens., p. 50.

“Country Almond” of India.

This plant is also a native of India. The seeds are like almonds in shape and whiteness, but, though palatable, they have none of their peculiar flavour (*Treasury of Botany*).

Queensland.

199. *TERMINALIA OBLONGATA*, *F.v.M.*, N.O. Combretaceæ, B.Fl., ii., 499.

“Yananoleu” of the aboriginals.

The purple fruit is edible.

Queensland.

200. *TETRAGONIA EXPANSA*, *Murr.*; (Syn. *T. inermis*, *F.v.M.*), N.O. Ficoideæ, B.Fl., iii., 325.

“New Zealand Spinach.”

This plant was introduced to England by Sir Joseph Banks on his return with Captain Cook from his first voyage round the world. As a substitute for summer spinach this plant has been grown in private (English) gardens for many years past, and it yields a large produce, which in the hands of a skilful cook may be made an excellent vegetable dish, though inferior to spinach. The chief objection to it as a cooked vegetable is the abundance of mucilage, which gives it a somewhat slimy consistence (*Treasury of Botany*).

It should be eaten when young, as when mature it possesses some acidity.

It is already cultivated to some extent in Australian gardens, but it is abundantly wild at many parts of the coast.

All the colonies.

201. *TETRAGONIA IMPLEXICOMA*, *Hook. f.*, (Syn. *Tetragonella implexicoma*, *Miq.*), N.O. Ficoideæ, B.Fl., iii., 326.

Called “Ice plant” in Tasmania.

Baron Mueller suggests that this plant be cultivated for spinach.

All the colonies except Queensland.

202. *TIMONIUS RUMPHII*, *DC.*, (Syn. *Polyphragmon sericeum*, *Desf.*; *Guettarda polyphragmoides*, *F.v.M.*), N.O. Rubiaceæ, B.Fl., iii., 417.

“Kavor-Kavor” of the aboriginals.

The aborigines are particularly fond of this fruit, which has much the appearance of the crab or wild apple of Europe (Thozet). Queensland and Northern Australia.

203. *TRIGONELLA SUAVISSIMA*, *Lindl.*, N.O. Leguminosæ, B.Fl., ii., 187.

"The perfume of this herb, its freshness and flavour, induced me to try it as a vegetable, and we found it to be delicious, tender as spinach, and to preserve a very green colour when boiled." (Mitchell, *Three Expeditions*, p. 254). It is an excellent antiscorbutic.

All the colonies except Tasmania and Queensland.

204. *TYPHA ANGUSTIFOLIA*, *Linn.*, (Syn. *T. Brownii*, Kunth; *T. latifolia*, G. Forst.; *T. Shuttleworthii*, Sond.); N.O. Typhaceæ, B.Fl., vii., 159. Muell. Fragm., vii., 116.

Called "Bullrush," and also "Cat's tail" and "Reed Mace." It is the "Wonga" of the Lower Murray aborigines.

The young shoots are edible, and resemble asparagus. The root is excellent. The pollen is used as food by the natives of Sind, India, being made into cakes (Dymock). It is used for the same purpose in New Zealand.

In a paper by Gerard Krefft (*Proc. Philos. Soc. N.S.W.*, 1862-5.) "On the Lower Murray Aborigines," the following description is given by him of the method of preparing these roots for food. He gives the species name as *T. Shuttleworthii*, but this has been merged in the present species:—"At a certain period, I believe January and February, the women enter the swamps, take up the roots of these reeds, and carry them in large bundles to their camp. The roots thus collected are 12 to 18 inches in length, and they contain, besides a small quantity of saccharine matter, a considerable quantity of fibre. The roots are roasted in a hollow made in the ground and either consumed hot, or taken as a sort of provision upon hunting expeditions; they are at best a miserable apology for flour, and I almost believe it was on account of the tough fibre thus obtained that these roots were made an article of food."

This plant is also termed the "Asparagus of the Cossacks," the Cossacks of the Don being very fond of it. They prepare it like asparagus, and cut it, like the latter, when the young shoots are pushing; the tender blanched part is boiled in water seasoned with salt, and served up in the same way as asparagus. The various culinary preparations to which asparagus is subjected are suitable for *Typha latifolia*. In collecting it they peel off the cuticle, and select the blanched tender part, usually about eighteen inches in length, near the root, and this constitutes a dish cool, agreeable and wholesome (*Pharm. Journ.*, vii., 543).

For notes on the economic value of this plant, see also *Proc. R.S. Tasmania*, 1882, p. 163.

100 parts of the entire plant contain, after drying, 9·58 per cent ash; and the ash contains, in 100 parts:—

Potash.....	14·8
Lime.....	21·9
Magnesia.....	1·56
Ferric Oxide.....	0·2
Sulphuric Anhydride ...	2·5
Silica.....	0·6
Carbonic Acid.....	21·0
Phosphoric Pentoxide.....	3·9
Potassium Chloride.....	16·8
Sodium Chloride.....	16·9

(Schulz-Fleeth, *Watts' Dict.*, v., p. 930).

The pollen contains:—

Stearin and Olein.....	3·6 per cent.
Sugar.....	18·3
Starch	2·0
Pollenin	25·9
Magnesium and Potassium Phosphates, together with small quantities of other potassium salts.....	2·5
Silica	0·4

The root-stock contains, in the fresh state, according to Lecocq, in December 12·5 parts starch to 73 parts water; but in April only 10·5 parts starch to the same quantity of water.

A decoction of the root is said to be used in Turkey as a remedy for dropsy and snake-bites (Landerer, *Watts' Dict.*, v., 930).

Throughout the colonies.

205. *TYPHONIUM BROWNII*, Schott, (Syn. *Arum orixense*, R.Br.), N.O. Aroideæ, B.Fl., vii., 154.

“Merrin” of Central Queensland aborigines.

The tubers, which are yellow inside, are manipulated in the same way as those of *Caladium macrorrhizon* (No. 51, q.v.), but none are watery, and they are made to adhere together after the first roasting.

New South Wales to Northern Australia.

206. *VIGNA LANCEOLATA*, Benth., N.O. Leguminosæ, B.Fl., ii., 260.

This twiner produces, along with the ordinary cylindrical pods, others underground from buried flowers, and these somewhat resemble common ground- or pea-nuts (O'Shanesy).

South Australia, New South Wales, Queensland, Northern and Western Australia.

- 207 *VITIS HYPOGLAUCA*, F.v.M., (Syn. *Cissus hypoglauca*, A. Gray; *C. australasica*, F.v.M.), N.O. Ampelideæ, B.Fl., i., 450.

“Native grape,” “Gippsland grape.”

This evergreen climber yields black edible fruits of the size of small cherries. This grape would perhaps be greatly improved by culture (Mueller).

Mr. Bidwill's life was saved when he was lost in the bush by the water he was able to procure by incising one of these vines (Dr. George Bennett).

Victoria, New South Wales, and Queensland.

208. *VITIS OPACA*, *F.v.M.*, (Syn. *Cissus opaca*, *F.v.M.*), N.O. Ampelideæ, B.Fl., i., 450.

"Burdekin vine," "Round yam." "Yaloone" is the aboriginal name (Central Queensland) for the large ones, and "Wappoo-wappoo" for the small ones.

The tubers are very numerous, and some weigh from 5 to 10 lbs. They are eaten after immersion in hot water like water-melons (the small and young ones are the best); they are, however, difficult to digest (Thozet).

It is probably the yam alluded to by Leichhardt, (*Overland Expedition to Port Essington*, p. 150). "Both tubers and berries had the same pungent taste, but the former contained a watery juice which was most welcome to our parched mouths."

New South Wales and Queensland.

209. *XANTHORRHEA* spp., N.O. Juncaceæ.

"The bases of the inner leaves of the grass-tree are not to be despised by the hungry. The aborigines beat off the heads of these singular plants by striking them about the top of the trunk with a large stick; then they stript off the outer leaves and cut away the inner ones, leaving about an inch and a-half of the white tender portion joining the trunk; this portion they ate raw or roasted, and it is far from disagreeable in flavour, having a nutty taste, slightly balsamic" (Backhouse).

The centre of the stem contains about 5 per cent. of sugar.

"The interior or pith of the tree is broken up. It is then subjected to hydraulic pressure, when a copious flow of the saccharine juice takes place. About twenty gallons to the ton are obtainable. On distillation this quantity of raw juice yields four gallons of proof spirit" (Ligar, *Trans. R.S. Victoria*, 1866).

In the year 1876 an application (which lapsed) was made at the Patent Office, Melbourne, for a patent for making sugar from *X. hastilis*. Following is the specification:—

"The substance used is the inner white or cellular portion of the plant. This is submitted to pressure, mechanical or hydraulic. The juice expressed is boiled till a scum rises to the surface. This scum is skimmed off, lime being used to assist in the operation. After clarification, the juice is filtered through animal charcoal, and again boiled. The clear syrup thus produced may then be crystallised and manipulated by the process used to produce sugar from cane."

210. *XIMENIA AMERICANA*, Linn., (Syn. *X. elliptica*, Forst.; *X. laurina*, Del.; *X. exarmata*, F.v.M.), N.O. Olacineæ, B.Fl., i., 391. *X. elliptica* in Muell. Cens., p. 63.

This plant bears round orange-coloured fruits, of which the natives of the South Sea Islands are very fond, though they are rather tart (*Treasury of Botany*). Before they are ripe they possess a powerful odour of essential oil of almonds.

211. *ZIZYPHUS JUJUBA*, Lam., N.O. Rhamneæ, B.Fl., i., 412.

"Jujube" tree of India. "Balyan" is an aboriginal name, but of course it is different to the "Balyan," of p. 555.

This tree yields an excellent dessert fruit, and is largely cultivated by the Chinese, who recognise a great number of varieties, differing in the shape, colour and size of the fruits (*Treasury of Botany*). In India it is much cultivated.

Queensland.

212. *ZIZYPHUS CENOPLIA*, Mill., (Syn. *Z. celtidifolia*, DC.; *Z. rufula*, Miq.; *Z. Napeca*, Roxb.), N.O. Rhamneæ, B.Fl., i., 412.

In India the fruit is eaten by the natives, its taste being pleasantly acid, and a great favourite with the thirsty traveller; mice are fond of it (*Cyclop. of India*).

Northern Australia.

“BALYAN” (? *Typha angustifolia*).

“The principal food of the inhabitants of the Kalaire or Lachlan appeared to be “balyan,” the rhizome of a monocotyledonous plant or bulrush growing amongst the reeds. It contains so much gluten, that one of our party, Charles Webb, made, in a short time, some excellent cakes of it; and they seemed to me lighter and sweeter than those prepared from common flour. The natives gather the roots and carry them on their heads in great bundles, within a piece of net. . . . And indeed this was obviously their chief food among the marshes” (Mitchell, *Three Expeditions*, ii., 61).

APPENDIX.

Anoplognathus cereus (See *Eucalyptus corymbosa*).

I cannot, up to the present, trace any account of this species of *Anoplognathus*.

Cicada moerens—The “Great black or Manna Cicada.”

In the *Prodromus of the Zoology of Victoria*, by Prof. McCoy, Decade V., Plate 50, will be found admirable drawings of this insect, and also a full account of its life-history. From this source the few particulars following are taken:—

The young resemble fleas in size and shape; they quickly reach the ground, into which they burrow, and whence they may be dug out at the roots of trees any time during the larval and pupa states. The larva is white, and seems to feed on underground roots; the eyes, six legs, and antennæ agreeing with the pupa, which chiefly differs in having the rudimentary wings visible at the sides of the body. The pupæ ultimately come out of the ground, crawl up a few feet on the trunk of the nearest gum-tree in the night, and then, splitting along the back, the surprisingly larger, winged, perfect insect creeps out, leaving the empty pupa skin clinging to the tree quite perfect, even to the

smallest hair or other part; in the position of life. . . . Both sexes have short lives in the perfect state, and may be seen lying about the ground under the trees, dead or dying, in abundance after their noisiest few days. This particular species chiefly frequents *Eucalyptus viminalis*.

Psylla Eucalypti—An homopterous insect which, on the leaves of *Eucalyptus dumosa*, produces “Lerp Manna” (q.v.). This and many other species are in the preparatory stages covered with a white cottony secretion, and their excrement forms threads or masses of a gummy sucroseous nature.

See a paper by Thos. Dobson, B.A., in the *Proc. R.S. Van Diemen's Land* of 1851, on the life-history of this insect. Excellent plates and full particulars of its life-history are given. A reprint of a paper by Dr. Anderson of Edinburgh, on the same subject appears in the same volume.

GEOGRAPHICAL NOTES IN MALAYSIA AND ASIA.

By THE REV. J. E. TENISON-WOODS, F.G.S., F.L.S., &c.

HON. MEM. ROY. ASIAT. SOC. (STRAITS BRANCH).

The following paper is founded on some of the brief notes made on the geography and physical geography of the various countries visited by me during the years 1883-84-85-86. It will include some account of what was of principal interest to me in the Malayan Peninsula and Indian Archipelago, southern and eastern Asia, the Philippines and Japan. I have only to say by way of introduction, that this paper is more brief on some details than others, because they form the subject of special papers in the Proceedings of this Society.

JAVA.

My objects in starting were mainly of a scientific nature. Geology and botany were the principal subjects of my inquiries, but at the same time everything connected with natural history had what attention I could give, while I lost no opportunity of making collections in every department of natural science.

I left Brisbane early in August, 1883, in the B. I. Co.'s Mail Steamer "Chyebassa," bound for Java. After passing near enough to Sumbawa to see some effects of volcanic action we came in sight of Lombok, the peak of which, 11,000 feet high, was grandly visible above the clouds. I landed in the pilot boat at Banjuwangi with two companions, Messrs. Weld-Blundell and W. Allen, M.P., intending to spend a couple of months in the examination of the whole of the island of Java. I have already published an account of this portion of my travels through the

island, in which I somewhat briefly and hurriedly described the journey and some of the sights and scenes of the island. I need do no more than summarize what was written, adding such observations as were then omitted.

BANJUWANGI.—Banjuwangi or more properly speaking Banuwangi (the *n* in the first syllable being a nasal *ng* sound) meaning in Malay fragrant water or river, is the name of a sub-district on the eastern end of the island, probably its wildest and least populous portion. It is only an assistant residency, being subject in its administration to the Resident of Besuki. Though to a stranger, who has not seen much of Java, it appears thickly populated, in reality it is not so. The town is built on the alluvial flats of the river Tambong which descends through a valley of lava on the slopes of the great slumbering volcano Ijen, which according to the Dutch engineers is 3,053 metres above sea level, or say in round numbers about 10,000 feet. It is an immense oblong crater or valley of subsidence, connected with a crater 9 or 10 miles in its greatest length from north-east to south-west, and 5 or 6 in its greatest width, with a large opening or gorge on the south-east side down which the river Tambong flows. East and west of this valley there are two crater lakes on the summit of the mountains: Ijen (10,000 feet), and Rawun (10,300 feet). The first name signifies *alone*, and the latter a morass or lake. Ijen is said to be filled with water containing a strong infusion of sulphuric acid, and once during an eruption the terrors of the inhabitants were vastly increased by great streams of this acid water pouring down over the slopes causing wide-spread death and destruction. Both these lakes are worth an attentive study, as they are distinct craters with a large number of lava streams dependent upon them. These form ridges and mountain crests, extending more than 40 miles from the mountains. It would be too long a task to attempt to describe these mountains in detail. It will be sufficient to say that the two volcanoes and the immense extinct crater between them form the nucleus of the mountain system of this end of Java. All the

ranges without exception have been formed by lava streams, or ash deposits from the volcanoes. They radiate out here like the spokes of a wheel from the two main craters. There are, however, two exceptions. One is the south-east peninsula forming the western coast-line of the strait of Bali. This is an independent volcanic mountain system. The northern point of the eastern end of Java is another extinct crater named Mount Baluran, about 4,000 feet high.

In consequence of these ridges dependent upon Mounts Ijen and Rawun, there is very little level agricultural land north of Banjuwangi. To the south, however, there is a moderate quantity of most excellent quality on the alluvial banks of the rivers Tambong, Batih, Bomo, and Kebaman. In this agricultural area, which may include 100 square miles or more, there is the town Rogo Jampi and about a dozen villages or campongs.

One excellent mail-post road has been made through all the district now referred to, extending nearly 20 miles south of Banjuwangi, as far as the river Stail and the village Kradenan, almost at the south-east extremity of Java.

After a short stay at Banjuwangi I started in a horse conveyance for Besuki, a distance of 87 miles. This town lies due north-west of Banjuwangi, and is distant about 50 miles, but the road goes along the coast, first north and then west. In the first part of the journey the road follows the sea-shore for about 10 miles, being often hemmed in on the west by precipitous escarpments of basaltic rock. The following villages were passed:—Sukawidi, Ketapang, Watu Dodol, Sumur, Wongsorejo, and Bajul Mati. Sumur is a female convict depot, where we saw female prisoners employed in making tiles and bricks. I should mention that the whole of the Banjuwangi district is used as a kind of place of exile for female prisoners from other parts of Java. Wongsorejo is a very remarkable Javanese village, with bamboo dovecots suspended in mid-air in the most picturesque fashion. Bajul Mati is built on the banks of the river of that name. It is the boundary between the provinces of Banjuwangi

and Besuki, formerly separate kingdoms. Here there is a government bungalow, and the traveller can be provided with rest and refreshment by the chief of the village. The country around abounds with game, especially deer, wild-boars, and pheasants. Travellers are waited upon by villagers summoned by the chief of the village, who provides them with everything necessary at a regulated tariff. This interesting locality with its people would well deserve a more lengthened description, but in this essay space renders it necessary to confine details to physical geography, geology, and natural history.

The government road between Banjuwangi and Bajul Mati is, as already stated, along the sea coast, deviating very slightly to the west of north. But after crossing the river it turns to the north-west to skirt round the small volcano which lies due north, and forms the promontory of Cape Sedano, the north-easterly end of eastern Java. This is Mount Baluran, an extinct crater 4,100 feet above the level of the sea. It is a long horse-shoe-shaped crater, densely clothed with jungle, open to the north-eastern side, and giving an outlet to a narrow stream about 5 miles long, which takes its origin in the inside slopes. With regard to this crater, I could not obtain any information as to its recent activity or otherwise. The Dutch can only be said to have settled in this part of the country since the commencement of this century, during which time Mount Baluran has not given the slightest signs of disturbance.

MOUNT BALURAN.—Our road now lay across the rugged slopes of ash and lava streams between Mount Ijen and Mount Baluran. The distance to the neat village named Sumbor Waru is 15 miles. The road is not made: there is in fact no more than an open track without boundaries or hedges, covered with a scanty vegetation on the barren stony ridges of teak, *Tectona grandis*, L. f.; *Acacia farnesiana*, Willd.; *Lantana camara*, L.; and large trees of *Borassus flabelliformis*, L.; and this is the vegetation on the stony volcanic soils throughout the Indian Archipelago and the Philippine Islands. This barren region is

absolutely uninhabited except by wild beasts ; and that can be said of very few portions of Java. There are no signs of human occupation in all the tract.

The village of Sumber Waru lies outside the north-western lava slopes of Mount (or Gunong) Baluran. It is situated on a small stream which comes from the slopes of Mount Ijen, but though the name is not marked on the Dutch maps, it is probably Sumber. The country around the village is exceedingly picturesque, with a dense shade from tamarind, angin (*Pterocarpus*), and red sandal-wood trees (*Adenanthera pavonina*, L.). After crossing the river Sumber, the road is again a government road, carefully made and planted with tamarind trees, making a dense shade. At about four miles the river Banju Pait (bitter waters) is crossed. This is a remarkable stream coming directly from the very crater of Mount Ijen, and being strongly impregnated with its sulphurous acid and other mineral constituents. The stream is about 30 miles long, including windings. Its sources are about 10,000 feet above the sea-level, coming from within the walls of the immense crater, and running along their inner edge for seven or eight miles. This curious river and its one small tributary, also within the crater, are well worth a visit, and a careful investigation of the chemical qualities of the waters. I am not aware that any traveller has called attention to them.

After crossing the river the road leaves the slopes of the volcano just mentioned and proceeds in a W.N.W. direction along the sea coast. The country improves and is a wide, level and very fertile plain about 160 square miles in extent. The view from the shady grove of tamarind trees forming the road, is very picturesque ; to the north is the sea ; on our left was Mount Ijen about 16 miles distant in a straight line ; behind us was Mount Baluran ; while in front, to the west was Mount Ringit, a rugged extinct volcano to be described presently, some 4,095 feet above the level of the sea. The plain is of the richest description, being formed by alluvium brought down by the rains from the slopes of the different volcanoes, and is carefully cultivated, being covered with farms and a dense population. At $6\frac{1}{2}$ miles Assembagus is reached ;

an extensive town entirely occupied by Javanese and Chinese, with a native ruler of royal descent and being probably a kind of rajah. His residence and the large roofed enclosure in front form the only important buildings in the place. To the next and less important town of Arjassa is $7\frac{3}{4}$ miles along the government road crossing the river Tikus (rat). At $5\frac{1}{2}$ miles further, skirting the edge of the plain, the village of Kapongan is reached and the road turns to the south-west for 4 miles to the large town of Situ Bondo. This is a very thickly populated locality, and it was here we saw the first signs of the sugar industry. Large quantities of cane were being brought in to be crushed at the European mill established in the centre of the town. Most of the inhabitants seemed somewhat different from the Javanese, being swarthy and thickset, but altogether fine powerful men. These were from the island of Madura, and it is said that the laboring classes of this part of Java are recruited principally from that island. Situ Bondo is an exceedingly picturesque town, apparently thickly populated with a thriving industrious people. The gardens around and the verdant shady aspect of the streets made on my mind an agreeable impression of the freshness and luxuriance of the tropical vegetation.

BESUKI.—Besuki lies due west of Situ Bondo, not more than 20 miles distant in a straight line. Between these two towns, or rather to the south of the straight line between them, is the great extinct volcano of Ringit, a crater of nearly seven miles in diameter. This mountain is close to the sea, but there is a road between it and the water not more than 22 miles long, but so broken and rugged that it is not much used. The other road goes right round the mountain, proceeding for half its distance along the river Sampejan, the largest stream on this eastern end of Java. It is a narrow river, though bringing down a great body of water. Some of its tributaries drain the slopes of Rawun and Ijen. The main stream is derived from Gunong Jang* an extinct crater

* In Javanese-Malay Gunong is a mountain, as in most Malay districts : a river is Sungei, but in this part of Java it is Kali.

10,105 feet above the level of the sea and 8 miles distant from Ringit. The road passes over the lava and tufa deposits between the two mountains. It is not so rugged as one would expect. The country around is desolate jungle and much infested with wild animals, tigers, leopards and panthers being especially abundant. The first part of the road 7 miles distant from Situ Bondo to Pragekan, is exceedingly interesting by the banks of the river which runs with a rapid torrent over a rocky bed. From thence to Bondo Wosso (19 miles) four populous villages are passed; namely, Klabang, Tapan, Wonosari and Tangsit. These are mere villages or campongs, but Bondo Wosso is a large town quite as large as Situ Bondo, if not larger. Between Bondo Wosso and Besuki, there are only the campongs of Poler $3\frac{1}{2}$ miles, Wringin distant $4\frac{1}{2}$ miles, and Budawan 6 miles.

Ringit is a mountain which has been quite recently in activity. A most destructive eruption took place from it in the year 1586, on which occasion the whole of an area near the sea coast nearly 50 square miles in extent fell in, engulfing whole villages and their inhabitants. My own opinion is that there were no villages there at the period mentioned, for there is pretty good evidence of an old crater having existed before the historical eruption took place. But there are many unequivocal signs of an enormous subsidence, which has left a wide ring of jagged walls, as abrupt and broken as can be well imagined. The pinnacles and high isolated needles of tufa bear silent testimony to the extent and violence of the disturbance. An immense number of people perished. From the inclination of the beds of ash that remain on the sides, I should think it would be quite easy to calculate the former height of the mountain, which probably was fully 10,000 or 11,000 feet. At present the highest part of the walls does not exceed 4,095 feet, though Crawford gives it as 4,200. The walls are riven into such precipitous detached peaks that scarcely any jungle grows upon the barren heights, which are in most cases quite inaccessible. The volcanic fires seem quite extinguished, and this, tradition says, has been the case since the last eruption, but there are no authentic records. It is a somewhat curious fact

that the name Ringit means a puppet, such as is used at the wayongs or scenic representations of the Javanese.

About Gunong Jang I can give no information, for I believe there are no records amongst the Javanese historians. From the crater a river (Kali Jolumany) takes its rise, flowing for about 7 miles along the western wall, then having a course of 14 to Besuki, where it enters into the sea. The appearance of the lavas is not so recent as that of the other mountains.

This, then, is the physical geography of the eastern end of Java, which extends as a peninsula almost east and west nearly 100 miles long, with an average width of about 45 miles. There is no mountain range, but four craters at the north-eastern extremity, forming a rough quadrilateral. The highest is Mount Jang, but Ijen, though only slightly lower, is of wider extent. The latter mountain is decidedly the one to which the elevation of eastern Java above the sea is mainly owing. Its lava streams and tufa deposits in fact form the extreme eastern end of the island. Mounts Baluran and Ringit, though wide in their craters, are much lower, and have not given rise to any extensive lava streams or tufaceous deposits.

The town of Besuki is a seaport of some importance, being visited by many British and American ships for sugar, indigo, coffee, tea, and pepper. Like all the inland towns of Java, its streets may be said to be a series of gardens, and, though very wide and open, are beautifully shaded with lofty fruit trees of tamarind, bread-fruit, jack-fruit, mangoes, &c. A few days at Besuki are well spent in looking around. The sugar plantations are large, with some fine plants for crushing and so forth.

PROBOLINGO.—Continuing westward from Besuki the government road keeps to the coast-line, passing through a number of important campongs in the following succession:—Banju Anget, Binor, Matikan, Paiton, Randumelah, Jabung, Kraksaan, Pajera-kan, Pranti, Gending, Dringu, and Proboling. The last-named is a very important seaport with a large population, deriving its

name, according to Crawford, from prabu a lord, and linga the Hindoo priapus, an emblem of the goddess Siva, and of the Phallus worship which once prevailed there. It is also called by the Malays Banga, or the "fetid." He adds that the place has been colonized from Madura about 150 years ago, and on this account it is Madurese and not Javanese, which is the language of the country about. The dialects are of two kinds of Malay, but intimately connected with the language of Bali, and having many words in common with that of Sunda.* The appearance of the town is prepossessing in the extreme on account of the beautiful way in which the wide streets are laid out in gardens. As a matter of fact, this is the case with all the towns under Dutch influence in the Indian Archipelago. But some show the effect of this supervision more than others, depending in a great measure on the number of Europeans resident in the town. This of course is proportionate to the population, importance, industries and commerce of the seaport. In Probolinggo there is a large sugar industry and export trade. The town is furthermore adorned with a pretentious looking club-house. There is an hotel also, which is by no means to be found in every large town in Java. On account of some family rejoicings amongst the native princes, I saw Probolinggo in its holiday attire, in beautiful though hot weather, and certainly it left a pleasing impression. There is a curious circumstance about the customs of this people; as a rule throughout Java the land belongs to the inhabitants, in the sense that it is held by the villages or campongs for the benefit of the free native population. But in Madura there is a private hereditary right of property which exists nowhere else in Java except amongst the Sundanese, and those colonists who occupy this district. Probolinggo is the capital of a province extending across the island.

*For further particulars about the Javanese, Madurese, Balinese and Sundanese dialects, see Rallies' History of Java, Vol. I., p. 400. In the provinces east of Surabaya the language partakes much of the Madurese. See also Crawford's "Dissertation on the Grammar and Dictionary of the Malay Language."

Twenty-five miles further along the coast brings one to another important seaport named Pasuruan, the centre of a new province of the same title, which is derived from the Madurese name for the Betel pepper. The boundary between the two provinces occurs about half-way between the two towns, at a somewhat large village name Mladten. The new province extends also from sea to sea, with an area of about 1,800 square miles. The boundary may be said to follow to some extent the elevated region formed by Mounts Tengger and Semeru, which lie in about the centre of a line drawn from north to south of the island. These two volcanoes are the centre of elevation of this portion of Java. There is no other mountain hereabouts, or between these volcanoes and Mounts Jang and Ringit to the eastward, except Mount Lamongan, a small crater 4,150 feet above the level of the sea.

Mount Tengger with the active crater of Bromo is 7,200 feet above the level of the sea and Mount Semeru 12,500 feet. No two volcanoes in this part of the island have served to modify the land to such an extent as these two, which may be considered almost as one. As they are both favorite resorts for travellers some short description will be interesting.

TENGGER.—Mount Tengger may be considered as a subsidiary crater belonging to Semeru, and has covered the country around with ash deposits. There is not much lava visible, and indeed this may be said of most of the volcanoes in Java. Near the summit of the mountain, but not at its highest point, there is a large ancient crater called the Sand-Zee by the Dutch, and Dasar (floor) by the natives. The Sand-Zee is described by Dr. Horsfield as being by far the largest crater in the island, and probably the largest in the world; but this is quite incorrect. It is not half the size of the craters of Mounts Jang and Ringit, and probably not a third of that of the amphitheatre of Mount Ijen. It is the most accessible of any; in fact it may be said to be the only accessible crater in this part of the island. There are many roads by which it may be approached, either from Probolinggo, Pasuruan, or Malang, to be mentioned presently, are the usual

routes. From Probolinggo is the shortest. There is a good carriage road of 16 miles from Probolinggo to Sukapura, and then a steep climb up the mountain side and across the crater of about 20 miles to the hostelry of Tosari. This route enables one to see more of the country, as ponies may be obtained to continue the journey to the sanitary or hill station of Malang. The guides at Tosari can be easily obtained for the ascent of Semeru, a journey of no great difficulty, but requiring a little more endurance and strength. Of course when the volcano is unusually active the attempt cannot be made.

SEMERU.—The crater of Semeru is a basin of 3 miles or more in its greatest length from north to south, with a peak or cone in the centre. There is a wide opening in the walls on its eastern side leading down to the town of Senduro, this being a large lava stream. The active peak of Semeru, or the highest point of the mountain, is to the south of the ancient crater. From the peak immense ridges of tufa and scoriæ extend in a radiating semi-circular direction to the southward, a distance of 15 or 16 miles. The volcano is always in activity, and sometimes sends forth a huge puff of smoke and a shower of cinders and stones, accompanied with loud explosions every quarter of an hour. It is the highest mountain in Java, and its name is said by Crawfurd to be derived from two Sanskrit words: *Su*, a qualitative of excellence, and *meru*, the Olympus of the Hindoos; but I must say that these very apposite etymologies are somewhat suspicious. Their simplicity is their fault; for probably the clue is much more recondite and lies deeper below the surface.

The route chosen by me when visiting the Tengger mountain was to take the railway from Pasuruan to Malang, a distance of say 45 miles, and then across the country E.N.E. to Tosari, 15 miles further. This enabled me to see the wonderful ruins of Singosari. These are situated near Malang, which itself is a sanitary station for the military, about 2,000 feet above the level of the sea. It lies on a table-land between Mount Kawi and Mount Tengger. The former is 9580 feet above the sea level,

and is an active crater, but of much smaller dimensions on its summit than any hitherto described in Java. To the N.N.E. is Mount Arjuno, another crater with a peaked and conical form about 10,000 feet high.

The ruins of Singosari have been described with much detail by Sir Stamford Raffles and by several observers. They are of evidently Hindoo origin, and lie in the midst of a jungle in an exceedingly picturesque locality, with mountains and the signs of tropical luxuriance all around. The frequent visits of sight-seers are gradually changing the aspect of the valley where the ruins are found; and in any case the coffee and quinine plantations on the slopes of Mount Tengger have brought so much population and civilisation into the neighbourhood that it is as well thronged as any in Java. I made a special visit to the ancient temples, and I extract the following account from a part of "A Journey through Java," published in the *Sydney Morning Herald* at the time:—

MALANG.—The railway ride to Malang is picturesque as well as most interesting. The ascent is along the slopes of the active crater of Mount Arjuno, called after the hallowed name of a hero famous in Javanese poesy. In the Hindoo poem of Mahabarat he stands pre-eminent as one of the five sons of Pandu, well known in all the legends of the Javanese. The mountain is one of the highest in Java, being 11,500 feet above the sea. Its sharp conical outline stood clearly out against the sky, while the cloud of smoke which capped it was glowing red in the sunset. This bounded our view on the north. To the south was the rugged extinct crater of Kawi, nearly 9,000 feet high. Every inch of the ground was under cultivation. The sides of the steep gullies were terraced with consummate care, and the water allowed to trickle and spread over bright-coloured rice-fields. The slopes were clothed with sirih, indigo, and cassava, and the ridges regularly planted with teak trees. The view across the plains towards the sea revealed a similar state of cultivation all over the land. Everything seemed smiling with fertility; the rice-fields especially giving a vivid green aspect to the distance which was charming.

One soon began to feel the effects of our elevation. The air got a little chilly, and mists commenced to wreath the valleys and obscure the view. Malang was reached about dusk. There are two hotels ; one close to the railway station with a fine view, the other two miles away in the middle of the town, beautifully placed on the side of the lawn esplanade and close to the residency. We stayed at the latter hotel and found it an excellent house, large as usual in every respect from the verandah to the wardrobes, and comfortable as usual, except for the odious custom of dining at 9 at night, equally destructive to good digestion and quiet sleep.

Malang is the sanitary station of Java. The hotel was surrounded by a bevy of small buildings, which are hired by the month by invalids, who try thus to get rid of their fever or recover from their cholera. Surabaya seemed to be the infected place whence most of the sickness came, and I must say the number of ghastly white faces around the dinner-table was rather significant of the climate on the coast. Still, if the towns were well drained, the drains covered over, and due distinction were made between the waters used for drinking, bathing, and draining, Java would not be such a pestilential place.

I cannot help remarking here on the hotel system, which is utterly different from what prevails in Australia. If a landlord here depended upon the sale of wines and spirits his business would collapse. There is no such thing as a bar. I have already said that spirits and bitters are placed upon the verandah tables before meals, and each one can help himself. There is no extra charge on the bill of six rupees a day. Wines, spirits or beer are bought by the bottle. What is not used at table is taken to your room. Only twice did I see a drunken man at an hotel in Java. The servants do not drink. In fact, labour is so plentiful, that the smallest fault is visited with dismissal, and though the wages are but a few cents a day, such a punishment is dreaded sufficiently to keep the humble Javanese servant in order.

There is not much to be seen in Malang, but the climate is delightful. The cool refreshing dew which mantles on the bushes

in the early morning, reminds one of a European summer. The place is a military station. There are barracks and a large training-school for recruits. Each morning from 6 to 9 o'clock about 800 men are drilled on the esplanade in front of the hotel, and this, with the practice on bugles and drums close by, makes it rather noisy for invalids. Most of the soldiers are natives. There is a languour about their movements, which, with their faded blue canvas uniforms, makes them anything but smart in appearance.

The suburbs of Malang consist of the Chinese quarter with plenty of shops and narrow streets. The rest is taken up in handsome European villas with tasteful flower gardens or shrubberies. They say that the town is very lively, as there are so many officers and civilians quartered there; but as a rule, English people will not find themselves received with open arms. I am afraid that the Dutch think we only come to criticise, and they are very sensitive about our criticisms.

We had to wait a day or so at Malang while arrangements were made for the ponies and guides to take us up to Bromo. As far as the hotel on the mountain of Tosari, we were told that there would not be much difficulty. Beyond that we could not get certain information. But all over the world there is a tendency to magnify the difficulties of such journeys. The fact was that any ordinary bush journey in Australia would be as arduous as getting to the foot of Bromo. Being in a strange country, with people speaking an unknown language, made the only real inconvenience beyond the fatigue. In all other respects life and property are as safe in Java as in any country of the world. The interim of waiting was taken up in driving about the country. The roads are very beautiful. The scenery, made up as it is by various views of the smoking peak of Arjuno and the rugged summits of Kawi was picturesque in a way that no short description could convey. All the intermediate valleys and plains were chequered by the different kinds of crops, of which rice was the principal. Large clumps of palm and other shade trees, with attap roofs showing here and there, were plentifully scattered

about, half revealing the numerous villages. Attap it should be explained is the common roof through all the Archipelago and Philippines. It is a roof formed of the Nibong palm (*Nipa fruticans*.)

There is a place of some resort about 7 miles from Malang, called Tampat Mandet, which name is literally the Malay for bathing-place. It is in a beautifully watered valley, the source of whose streams are natural springs of some magnitude. The authorities have walled in one of these, and converted it into a regular bath. The water can be seen welling out of the volcanic soil in great volumes. It is as clear as crystal, and no matter how the volcanic sand is stirred it is so purely siliceous that it does not make the water muddy. All around the Tamarind and Terminalia trees give a rich green shade. It is, in fact, like one of those places we read of in the Arabian Nights. This is the spot where the monkeys are held to be sacred. A call brings crowds of them into the branches above, where, I must add, they become a nuisance and give the bathers all sorts of annoyance. Fortunately, the bathing-boxes are well secured, or they would swoop down in crowds and carry off every article of clothing.

SINGOSARI.—About 8 miles north of Malang, and not far from the railway station of Singosari are the celebrated ruins of that name. Here it is stated that formerly a beautiful city existed which was the centre of a very extensive government. Sanskrit students have derived the name from “singa” a lion and the Javanese word “sari” which means either a flower or beautiful. About half a mile from the populous bamboo campong there is a delightful shady valley, now surrounded by cultivation, but in Sir Stamford Raffles’ time it was a dense jungle which quite hid the ruins. All this has been cleared away and the green sward planted with Frangipanni trees (*Plumiera acutifolia*) throughout the island; this is the tree with which cemeteries are always ornamented. On the right-hand side of the road, which turns away from the campong, there is a fine temple of thoroughly Hindoo style, rising in square terraces to a height of about 30

feet, and terminating in a small square pedicel, which may have been an altar. Inside this temple was a very small chamber, which has been much defaced. The entrance is on the western side, and one can still trace the steps leading up to it, though they have been considerably injured by earthquakes. Corresponding with the doorway there is a square niche on each of the four sides of the building, and over each an enormous dragon's head of hideous aspect. Inside the temple there is a deep excavation, and a large square stone with a round hole passing through the centre. This may have been a mortice for an image or an altar of sacrifice ; but it is hard to say, as so many of the images and idols have been carried away. There are traces of images in all the niches, and on the lower terrace from which the temple rises there are two small human figures with drawn swords kneeling on one knee. Besides these are various representations of the Brahminical divinities of Nandi the bull, and Maha deva known by his trident. The exterior of the building is highly ornamented with cornices and various mythological devices and representations. No mortar was used, for the stones have been carefully cut and morticed into one another. Throughout Java the stone found in such ruins is trachyte or dolerite, but this is a limestone such as is not now known to exist in Java. The appearance of the stone is darkened by mosses, lichens, and weathering, altogether having an air of great antiquity

A little further on there are two enormous images of colossal deities. They are exceedingly well executed, and the human portions of the figures are close imitations of nature. They are both well preserved, and cut out of one block of solid dolerite, being about 12 feet high and 9 feet across the shoulders. They represent men sitting on the right foot, while the left leg is bent up, and gives a rest for the left arm. The hand is extended on a heavy club ornamented with rings. The right hand is elevated, with the two middle fingers extended like a mediæval bishop giving a blessing. Over the shoulder is a serpent, worn like a baldric. The head-dress is a turban ornamented with human skulls, the ear pendants are also skulls, and there is a girdle of

skulls round the waist. The eyes are very prominent, so that the expression is one of surprise, especially as the mouth is half open, revealing two large canine teeth. Close by is a fine colossal statue of Ganesha, the Hindoo god of wisdom. He is represented as a short fat man, with the head of an elephant. He has four arms, in one of which he carries the elephant-hook or driver, in the second hand a shell, in the third a ball, and in the fourth some cakes, upon which his trunk is feeding. In every respect this figure corresponds with the common Hindoo representations of the elephant-headed Ganesha. There is also a fine statue of Brahma, with the four heads nearly perfect, though it has been mutilated. Fully a dozen statues of the bull Nandi have been excavated since Sir S. Raffles' time, as well as many other tablets and inscriptions. A part of the terrace on which these statues rested can be traced, as well as the foundations of several large buildings covering many acres of ground. There is a square stone pedestal which evidently supported some statue, and it represents the chariot of Surya, the god of heat and light, or the personification of the sun. He is seated on a splendid car with one wheel drawn by a seven-headed horse, but the heads are wanting, and the remains of this stone would lead one to believe that seven separate horses were carved upon it. Altogether the statues were more elaborate and ornamental than those usually seen in India.

There are plenty of inscriptions about ; in fact, there are stones which are just like tombstones standing straight out of the ground, and they are covered with inscriptions on both sides and on the edges. These are in the Devanagri character, or that in which Sanskrit is usually written. A good many of them have been translated, but they do not throw much light on the history of the building. They are usually passages from the Vedas and Hindoo scriptures. As to the date there are various opinions. They must at least have been erected before Mahometanism became the dominant creed in Java, which was certainly about the year 1478. It was then that the idols were overturned and disfigured, and thus we see Durga, Ganesha, Nandi, and Siva reduced to their present disreputable plight. Before that Singosari was a seat of

empire, and this was probably a temple dedicated to Siva. Contemporary annals give enigmatical memorial words for the date of these buildings. Thus the years A.D. 896, 964, and 1,360 have been variously assigned. The prevalent opinion is that they may not be more ancient than the 13th century.

It is strange that though ruins of ancient stone temples abound in the island, there are few of palaces or towns except very modern. From this we may infer that the Javanese have always built houses of wood as they do now. Between Malang and Lawang a great battle was fought, and in the year 1400 Majapahit, a fortified place of great splendour near Surabaya, was then destroyed. The remains of this city are still traceable.

It has often been remarked that the Mahometanism of the Javanese is very lax, and we saw here singular instances of it. When we came to the statue of Ganesha we found some Javanese women prostrate before it and making offerings of flowers. All the idols were covered more or less with fresh-gathered blossoms, and we were informed that these temples are resorted to from afar by the Javanese. Now, considering how Islamism reprobates pictures or figures of any kind, even for the purposes of art, this kind of devotion is very extraordinary. I took some of the flowers from off an idol to examine them, when one of the Javanese women burst into tears. Our guide told us that she had placed them there and looked upon my removing them as an unpropitious sign. Women not blessed with children make pilgrimages to these temples to obtain the gift of fertility.

The neighbourhood of Malang is very rich with ruins, and many of them have been removed. One of the principal persons who took an interest in the matter was a Dutch resident at Samarang named Engelhard, who had a good number of idols and inscribed stones removed and sent to Holland. Some of the best of them were also removed to the residency at Malang, for I saw a great number in the garden there. There were amongst them many upright slabs covered with Sanskrit inscriptions. The locality was no longer used as the residency, so that the whole of these valuable

antiquities were neglected and abandoned. There can be little doubt that they refer to the time when the kings of Majapahit were more or less acknowledged by the whole of Java. Java and Buli have both proved rich in manuscripts which give an account of this empire and its history. This explains fully why it is that the central parts of the island are so rich in antiquities. It was the centre of population and government, and in these regions most of all the arts and such science as they had, and religion were cultivated. These histories are only records of wars, usurpations, miracles, and battles, much as our history was at the same date. We may certainly conclude that a nation so cultivated in the arts as to produce these buildings and statuary would not have been much behind such civilisation as the world then possessed.

Near Malang there are many other ruins, such as Kedal, about 7 miles, and Jagu, 4 miles, in a south-easterly direction. In Kedal there are the remains of a beautiful temple, and at Jagu one of the largest in this part of the country, but it is utterly in ruins. There are only the remains of three stone terraces rising one above another. It was evidently much more elaborately carved than any except Borobodor, to be described subsequently. The ornaments were much in the same style. There were many bas-reliefs, representing battles and sacrifices, besides other carvings, throwing great light on the manners and customs of this most interesting people.

Altogether there is plenty for tourists to see around Malang, and, indeed, plenty to employ antiquaries and scholars. The great difficulty one experiences is to find out where these curiosities are. The people of the neighbourhood know little about them. Many of the Dutch could not give us the least information. Of course, in such a remote place a guide-book is out of the question. And as for the expensive works of Raffles, Horsfield, or Junghuhn, they are very difficult to obtain. A traveller who wishes to see everything should read, and even carry with him, the second edition of "Raffles' History of Java" (Murray,

London, 1830), and then, with the help of the excellent map published by the Batavian Government in 1878 (*Etappe-kaart* of W. Havenga) he can easily find out what there is to be seen. I consider, however, that there is still much to be explored. It is easy to observe how much more is known now than in Raffles' time. Quite recently a celebrated British orientalist, whose name I forget, visited these ruins. He deciphered the inscriptions with the utmost ease. In a paper read before the Batavian Society he assigned to them a date not earlier than the 14th century.

By the time we had seen a good many of the ruins about Malang—but probably not a tenth of what a lengthened examination might have enabled us to see—our arrangements were concluded for the journey to Bromo. We left Malang in a coach drawn by six ponies. My readers should by this time be able to appreciate the peculiar qualities of Javanese ponies when driven in pairs, and therefore they may guess what starting with six is like. The driver is a mere ornament; he sits upon the box, crowned with a hat like a gorgeous tea-tray, and he holds the ropes meant as reins; but, for the matter of guidance, these things might just as well be tied to his hat. The real work of driving is done by two bare-legged grooms, who run along by the side of the team shouting and lashing the ponies to the very top of their speed. When thoroughly winded these men mount behind to get breath, and then the process is repeated. It is really hard work, and has to be performed regardless of life and limb. Thus five miles is accomplished in less than half-an-hour, and both drivers and horses are changed. Fifteen miles performed this way brought us to the foot of the mountain, where six ponies and two guides were in waiting. With great ingenuity the guides strapped and tied our baggage on three of the ponies, and then we began our ascent up a winding road with villages and cultivation all along the slope. Where the post-road terminates is called Djabon. Henceforth the track was narrower and scarcely metalled, but still good. The mountain streams were crossed by substantial bamboo bridges, with higher structures occasionally swinging high in air for foot traffic when the large torrents were

swollen. These valleys of the lower slopes of the volcanoes of Java present us with the grandest aspects of tropical vegetation in the world.

PASURUAN.—The southern portion of the district of Pasuruan is formed by the barren rugged surface of mountainous lava streams and ash deposits which abut on the south coast. This part of the district is wholly uninhabited, and against it the southern seas dash from a deep ocean of which little is known, because on this part there is no harbour or even anchorage for vessels. Ten or eleven small streams about 6 miles long come down from the heights of volcanic rock into the sea; but none of them are more than 8 or 10 miles in length. The names of only three are known. This range of mountains is the watershed of this part of the island. On the north side of the range which has its origin in the slopes of Semeru, the river Lesti takes its course, its waters ultimately flowing into the Madiun, and so on into the waters which form the great delta of Surabaya.

SURABAYA.—North of the platform created by Mounts Semeru, Tengger, Kawi and Arjuno, the Javanese coast makes a sudden turn to the northward and the island becomes much broader. Thus at Probolinggo its narrowest part, it is not more than 35 miles wide, while 25 miles to the west of Surabaya it is nearly 100. The land forming the north coast-line west of Pasuruan which runs north and south, is formed by the delta of the river Surabaya; the northern branch being called Kali Mas (golden river), and the southern Kali Porong. There are other branches at Sidho-Arjo and Gedangan. North of Surabaya the river enters into the ocean at the narrowest part of the Straits of Madura, where in fact it is little more than a mile wide. To the west of Surabaya there is a deep bay and then the coast is again formed by the delta of the river Solo which is the largest in Java. Thus the land around the populous city of Surabaya is an immense alluvial deposit brought down from the loose tufaceous slopes of the highest mountains by two of the largest rivers which drain an immense

area. While the ranges and mountains connected with the craters are necessarily of a barren rugged character on their summits, their lower declivities, which are covered with a luxuriant vegetation, produce by their drainage a soil of unexampled richness and depth. Thus the country surrounding Surabaya surpasses any in Java for the extraordinary fertility of its soil. Hence the crowded population and the riches of the agriculture. The origin of the soil, its physical structure and its liability to inundation must necessarily, in such a climate, be unfavourable to human life. Cholera and fever seem never to be absent from this part of the country, affecting the natives and Europeans almost equally.

To the west of Surabaya the physical structure of the country alters. Here for the first time we meet with an extensive mountain range, which, though volcanic in character, has not any extinct crater for 100 miles or more. The basement of this range may possibly be on a line of fissure whence volcanic emanations arose in the form of craters which have disappeared by weathering. There are but few places where I had an opportunity of examining these beds, and all I saw was decidedly volcanic. But the face of nature has been so scored and changed by the system of irrigation which prevails, that unless on the very mountains themselves there is nothing for a geologist to see. The range runs almost east and west, with a very slight inclination northward at its western end. There are several parallel spurs with other subsidiary ranges at right angles. It is deeply scored by valleys of erosion, on the sides of which is an alluvial or coarse gravel formed of volcanic material. The west side is bounded by the valley of the Serang River, and through this the railway takes its course. All along the south side the river Solo has a very winding channel, following exactly the curves of the spurs from the mountain range, and flowing in a generally east direction.

MADIUN.—At about half the length of the range it is joined by the Madiun, a tributary nearly as large as itself, and then the united streams flow through a narrow and very remarkable gap in the range, and take a course north, north-east, and then finally

eastward to the north of Surabaya, as already described. The gap spoken of is at Ngawi, a town of considerable importance built on the peninsula formed by the two streams. This is in the province of Madiun, of which Madiun itself may be said to be the capital. There is no other gap in the range; but at the termination to the eastward the river Brantas flows around the end into the Surabaya. The river is in reality the higher waters of the Surabaya River. A singular fact connected with the physical geography and river system of this part of Java is that the three largest rivers of the island all have their sources within a few miles of the south coast. The sources of the Brantas are absolutely scarcely three miles from it. The island therefore may be described as an inclined plane from south to north, diversified by many large isolated volcanic cones and ash ranges, which may be said to run almost in every direction; but in the centre of the island there are two conspicuous east and west ranges which act as a barrier to the waters flowing down the inclined plane to the north until a gap is found, when they are thrown off towards the east, and disembody into the large alluvial delta already spoken of.

Between the sources of the Solo, Madiun, and Surabaya Rivers there are two lofty volcanoes whose slopes and dependent ridges cover a very large extent of country: Mount Wilis to the east, 7,086 feet above the level of the sea; and Mount Lawu to the westward, which is very little lower than Semeru, or about 10,100 feet. Both these mountains contribute largely to the sources of the Madiun and Solo; while on the northern slopes of Gunung Wilis two tributaries, one of the Madiun and the other of the Surabaya, are separated only by a narrow ridge of scoriæ.

SOLO.—The whole of this mountainous and volcanic region is as wildly picturesque as any country in the world. The immense height of the mountains and their volcanic activity, the marks of nature's convulsions on a truly gigantic scale would alone give a sublime interest to such a territory; but when we add the grandeur as well as the beauty of the vegetation, it truly presents aspects to the traveller which baffle description. The forests of teak and

other trees, as useful or as ornamental, the profusion of fruits and flowers, the shrubs and ferns, make it a region which stands alone amongst the wonders of nature. But when we add to this the beauties and varieties of the wild animals, the birds, the insects and the denizens of the seas and rivers, Java becomes almost a fairy-land to the traveller. On the slopes of Mount Lawu at a height of 3,600 feet, and again on another spur at over 4,000 feet are the ruins of the temples of Suku and Chato respectively. These are Hindoo in character, though from their rude and primitive structure, they would seem to have belonged to much less civilized times. However, any speculation is set at rest by an inscription with the date of 1361 of the year of Salivana which is A.D. 1439. The whole of this locality may be said to be the historical land of Java. It is here that the ancient empire of Suracata still exists. The traveller is at once struck in visiting this region with the ancient aspect of things. The costume of the people differs little, and that of the princes and nobles seems to have undergone little alteration since the days in which they were carved in stone on the trachyte walls of Boro-budur.

The valley of the Solo river is bounded on the west by the twin volcanoes of Merapi and Merabu, the first nearly 9,000 and the second nearly 10,000 feet above the level of the sea. The city of Jokiakarta lies on the southern slopes of Merapi, or rather on the plain at the foot of the mountains, and a stream which comes from its summit almost, empties itself on the south coast. From the city, which boasts of being the residence of the sultan or king of the province of Jokiakarta, there is a good road of 17 miles length to Galur, an important campong, on the few lowlands of the south coast, formed by the alluvium of the river Songo with its tributaries Krasac, Progo, Tangsie and Ello. This was the only time I was on the southern waters of the island.

JOKIAKARTA.—Jokiakarta is especially interesting to geologists, because of its beds of tertiary marl with fossils. On the river Songo, near Nangulan, about 8 miles west-by-north of the city of Jokiakarta, are beds of marl or limestone associated with Horn-

blende andesite, claystone, pyrolusite, and brown coal. Possibly these beds may be the equivalents of the tertiary coal deposits and eocene nummulitic limestones of west Sumatra.

Due north of Suracata is the Japara peninsula, on the coast which forms the most northerly portion of the centre of the island. This is entirely due to the large volcano of Murija, about 5,000 feet above sea level, separated from the range already described (which I distinguish as the Ngawi Range) by the valley of the river Tanggul Angin and its tributaries. The main stream empties itself on the west side of the peninsula. The coast slopes away S.S.W. from the mouth of this river to the city of Samarang. The intermediate country is formed of alluvial deposits from the somewhat important rivers Demak, Bujaran, and Agung-bajo. Samarang is the capital of one of the finest provinces of Java, with an area of about 1,425 square miles. It is densely populated, perhaps the most thickly populated of any portion of Java or the Indian Archipelago, including the Philippine Islands. The most of the inhabitants are Javanese, with about 30,000 Chinese and their mixed descendants, and 5,000 Arabs and other nationalities, amongst which there are a majority of natives of Celebes. It is a town which seemed to me next in importance to Surabaya, but far more attractive in appearance, as the streets are wider, more cleanly, and boast of much better buildings. The country around is also much more attractive. There is a pliocene formation with fossils in the province, and also a brown coal of which I saw specimens, though I did not visit the locality.

West of a line drawn north and south from Samarang the island narrows again, but not quite to such restricted limits as in the district of Besuki. The country has physical features which are easily described. It is one mass of small volcanoes mingled with the large peaks of Jeremai (9,500 feet), Slamet (over 10,000 feet), and Jakurag (about 9,200 feet). Of this part of the country I know nothing from personal inspection, except along the coast. There are three large seaports on the north coast, namely, Pekalongan, Tagal and Cheribon, about 50 miles apart; Pekalongan

being on the east, Tagal in the centre, and Cheribon on the west. These are the sites of large towns, the capitals of provinces which bear the same names. Though wide in extent they are not by any means amongst the richest provinces of Java. Cheribon may be considered as a province which forms a division between the Javanese and the Sundanese, the western portion of it being peopled by the latter race. The name is said by Crawford to be derived from *charuban* which in Javanese means a mixture. It was at one time an important kingdom in Java next perhaps to Bantam. The country to the south is so exceedingly rugged that it is perfectly unfit for cultivation and is but little known. There is one large river with many tributaries which drains from the slopes of Mount Papandayang in the kingdom of Sunda, and almost on the south coast. The mountain is over 8,000 feet above the level of the sea.

MOUNT PAPANDAYANG.—This is the celebrated volcano which, in the year 1772, was the locality of a tremendous earthquake or subsidence in which many people perished. It occurred at midnight between the 11th and 12th of August, beginning with the emission of dense volumes of steam which enshrouded the mountain in thick clouds. Shortly afterwards these clouds became luminous, and the inhabitants, who thickly peopled the lower slopes of the crater, were alarmed by the violent explosion and speedily took to flight; not however in time to save themselves, as the ground began to open and crack beneath their feet. Shortly afterwards an immense subsidence took place engulfing the most of the mountain and swallowing up the poor inhabitants into the depths of the earth. This was accompanied by a fearful noise, similar to that which happened at the subsidence of Krakatoa, which was heard over 900 miles away. It is estimated that the subsidence extended over an area 15 miles long by 6 wide, and it was said that the old mountain, which was one of the highest if not the highest in the island, had almost entirely disappeared except a few fragments of the lower slopes. From the chasm into which the crater collapsed, immense quantities of ashes, cinders and stones were ejected to a great height red-hot or in a half

molten condition. These ejectamenta covered the country around for a great distance, carrying great destruction to life and property. Previous to the disturbance the volcano had been so very quiet that agriculture and settlement had gradually extended up its slopes, and a numerous population was established around. It is supposed that over 40 villages were completely destroyed by the catastrophe. Some of these utterly disappeared by being swallowed up, while the rest were in a great measure covered over by the ashes, cinders and fiery rain. About three thousand people perished, besides cattle, live stock and large and valuable crops of cotton, indigo, Betel-pepper and coffee.* Altogether the eruption was a terribly destructive one, but nothing in comparison with that of Krakatoa in 1883.

CRAWANG.—The northern river, which takes its rise from this volcano, enters into the sea as the Riam Battam on the extreme eastern end of a wide prolongation of the north coast, beginning at Cheribon, and extending westwards to Batavia. The whole of this area is watered by at least ten rivers of various sizes, and gives rise to a large tract of alluvial marshy land of great richness, which forms the province of Crawang, 1538 square miles in extent. The low-lying lands are rich, but rather too marshy to be thickly populated, or at least so thickly as other districts in Java. The largest river, the Ji-Tarun, is the most westerly, and enters into the sea through an extensive delta on the east side of Batavia Bay.

BANTAM.—The rest of the western end of Java comprises the kingdom of Bantam, and its physical description is as follows:—The whole southern side of the island is composed of high volcanic ranges, dependent upon numerous cones which have been ancient points of eruption. The culminating point is Mount Halimun, an active crater about 5,300 feet above the sea. This is connected

* "Jaarboek van het Mijneuzen in Nederlandsch Oost-Indië. Pt. I., 1873, p. 114. Also, "Transactions of the Batavian Society of Arts and Sciences." Vol. IX., where there is an account of the eruption by Dr. Horsfield.

by a range to the eastward with Mount Salak (nearly 7,000 feet) and Panjerango (9,300 feet), which is an active crater, forming the eastern termination of the range, which here has a very wide extension southward. These two mountains are familiar to most travellers who visit Java and "*do*" the island by going from Batavia to Buitenzorg. They form one of the most lovely pieces of scenery visible anywhere in this beautiful island. It has been engraved so often as to need no description.

The north side of the kingdom of Bantam is formed of the rich alluvial plains, to the westward of Batavia, deposited by numerous rivers which have their sources in the mountains just referred to. The extreme north-west of the coast of the Straits of Sunda terminates in Mount Karang (5,350 feet) and Mount Pulde Sari (about 3,900 feet).

PHYSICAL GEOGRAPHY.—Briefly, then, the physical geography of Java may be stated thus :—A long and narrow volcanic island extending east and west; high and precipitous for the whole extent of its southern side, and consisting entirely on its northern side of low alluvial and, to some extent, marshy plains. These alluvial plains extend for long distances out to sea where the waters are extremely shallow, and the coast without the protection of any high land. The seas of the southern coast, on the contrary, are very deep, and scarcely affording any shelter for vessels. The high lands of the south coast are entirely formed by volcanic cones, connected with one another only by irregular ash and lava deposits which have flowed from them. Apparently there is no range of elevation apart from the craters, but it suggests itself that the ancient land, if there has been any such, was a range along what is now the southern coast. First of all, it is a watershed without a break of any kind. Secondly, whatever fossiliferous formations are found in the island occur in this range. Thus there are recognised miocene and pliocene rocks, and probably eocene beds as well. There is also a tertiary coal formation, and palaeozoic slates and schists or metamorphic strata. There are but few places where these rocks become visible,

possibly indicating the narrow limits of the land ere the volcanic outbursts commenced to modify it into its present form. The subsidiary ranges spoken of in the centre of the island appear to be entirely of volcanic origin. They are of small extent, and are pierced in one case by a large river. It is, however, to be borne in mind that in general direction they correspond with the main divide, which is the axial direction of the island, and of the volcanic fissure extending through so many islands to the eastward before it finally turns to the north towards the Philippine Islands.

One remarkable feature connected with the volcanic disturbance manifested in Java has been the part played by subsidence in the formation of craters. All of the mountains on the eastern side of the island have upon their summits craters of very large dimensions. In the preceding pages many instances of this have been given, so that it will be only necessary to mention Tengger, which is by no means the largest. Dr. Horsfield has left us a sensational description of this, which shows what it was in his time.

BROMO.—“This mountain,” he says, “constitutes one of the most remarkable volcanoes of the island. It rises from a very large base by a gentle slope with gradually ascending ridges. The summit, seen from a distance, is less conical than most of the other principal volcanoes, varying in height at different points from 7,000 to 8,000 feet. The crater is not at the summit but more than 1000 feet below the highest point, and consists of a large excavation of an irregularly circular form, surrounded on all sides by a range of hills of different elevations. It is by far the largest crater in the island, and probably exceeds in size every other crater existing on the globe. It constitutes an immense gulf, the bottom of which is level and denominated by the natives the *dasar* (the floor). This is naked of vegetation, and covered with sand throughout. In one portion in the middle, the sand is loose, and blown by the wind into slight ridges. To this the natives give the name of *Sagarawadi*, literally “sea of sand.”

The largest diameter of the entire crater is, according to my estimate, full three miles. From the interior, near the middle, rise several conical peaks or distinct volcanoes. The chief of these, the mountain Brama (in Sanskrit, the god Brama, or fire), is a perfectly regular cone and still in partial activity, with occasional eruptions. It is surrounded, on one side, by the sea of sand above mentioned. Adjoining it stands another conical peak, more than 1,000 feet high, named Watangan (the Javanese *Campus martius*), or Widadaren (abode of celestial nymphs), covered externally with sand, quite naked, and, on account of its steepness the top has never been examined. At a small distance from the Brama rises a smaller cone, called Butak ("the bald"). The two last have not exhibited any activity in recent times.

* * * The soil of the Tenger hills is extremely fertile consisting of a deep vegetable mould, accumulated for many ages on the sand and débris thrown up from the mountain. Vegetables of northern latitudes, potatoes, cabbages, onions, &c., are planted by the natives in great abundance, for the supply of the markets of Pasuruhan and Surabaya. European fruits, as apples and peaches are also raised, as well as wheat and other northern grains. Rice refuses to grow, and the cocoa-nut produces no fruit" (Geographical Preface and Postscript of "*Plantæ Javanicæ rariores*," 1852).

This was the description of the crater as Dr. Horsfield saw it in 1825. The following are my own experiences in September, 1883, when with two European companions I visited the sand sea from Tosari. We started early in the morning with a guide and two coolies carrying necessary supplies, of which water was one, for there was none to be had in the crater. The road was an open carriage-way for four miles, and then became a wide bridle-track, which descended into a thickly-wooded gorge. Here we saw many wild pea-fowls, and the forest resounded with their cries. There were no campongs, but plenty of those elegant bamboo houses by the side of the stream which flowed through the valley. The picturesque steep roofs, with the ornamental vertical gable reminded one of Swiss chalets. The temperature, too, reminded one of them,

for it was very cold, though clear. We soon again ascended into a treeless region. The grass was thick and rank, for there was no cultivation. It could easily be seen that we were approaching the scene of more active disturbance. The short billow-like hillock of ash grew more irregular and steep. Here, also, I saw many species of plants and ferns which I obtained nowhere else. A rather steeper climb than usual brought us to a miserable attap shed, built on a terrace cut out of the rock, and fenced in. All beyond and below that was then a white sea of mist, out of which came a dull, hoarse roar from Bromo.

We were on the edge of the large crater. Below us was the mysterious sand sea, and in the middle of that Bromo. It was scarcely eight in the morning, and the clouds had not cleared away. Above our heads the sky was shining brightly, but below all was like white wool. To the southward was Semeru, also shrouded in mist. While waiting for the morning to clear I took the bearings and altitudes of those peaks which showed, with the aid of a prismatic compass and pocket sextant. By the observations made going and returning I found the rest-house to be 7,237 feet above the sea.

I was just finishing with my water-boiling when the mist began to roll back. In ten minutes all had cleared away, and a scene emerged so rigid and severe that it was hard to understand how it had been concealed under those soft white fleecy clouds. But what a wonderful—what a desolate scene it was! An immense wide plain appeared 500 feet below us—so immediately below us that one would imagine it was easy to leap into it from the terrace where we halted. It was, in truth, a sand sea of greyish-brown, with rugged walls of slag and cinder all round. Sometimes these walls were blackened or reddened by fire, but more often grey and scored by the rains as if they consisted of fresh mortar. The sand sea seemed level and devoid of vegetation, though there is grass upon it. The creeks of last year's rains had made wide channels of ripple marks across the plain. They looked as if filled with running water, but they were perfectly dry, and so

was everything in this arid basin. From the further end a winding track or road can be seen descending the hill-sides and crossing the floor of the crater. This is the Probolinggo road which joins our road at the rest-house. I need not say that there are no trees or even a blackened, stunted bush. Scattered tufts of sedges grow here and there, but not sufficient to redeem the general aspect of sterility. The whole reminds one of unfinished excavations on a stupendous scale. In the middle of the floor is a steep conical hill, some 1,000 feet high, clothed with timber and yet scored by rains so as to leave deep ruts, crevices, and gullies of white or grey ash. Half hidden by this hill is Bromo. It is a lower cone, truncated, and wide. It is absolutely destitute of vegetation, and of a uniform whitish grey, darker than snow, and yet somehow bringing it to mind. The crater is backed by a higher and more rugged mountain with a still colder wintry aspect. The view is cheerless, indeed, as there is not a sign of life, either animal or vegetable. From the centre of Bromo rises a thick white smoke. It rises rapidly as if impelled by heat, and is thin or dense according as the bubbling noise of the crater is faint or uproarious. It is nearly 3 miles from where we stood, and we could feel the vibration very distinctly under our feet. Fortunately there were neither ashes nor stones ejected on that day, so we could make the ascent safely.

Five hundred feet of a descent on a bridle path, which made short zigzags in loose ash, brought us to the floor of the sand sea. Nothing but a Javanese pony would keep his foot upon it. Not that one could ride down. Blondin might, but all mankind are not so gifted in preserving a balance. It is no use troubling my readers with the process of staggering knee-deep in ash, which rises round one almost to suffocation. There are places where a false step might be fatal, but we did not manage to fall over these, yet falls we had plenty, and so must anyone, for there is no way of getting down except by sliding and falling.

But just before we left the platform the mist had rolled away from Semeru. It now appeared a grand mountain rising close to

us to a height which looked great even to us, elevated as we were. It seemed about 14 miles away. While we were gazing at its outlines a sudden eruption burst from its summit. First came a volume of black smoke, which rolled over and over like a turban as it rose up into the sky. As this spread a fierce fountain of ash and stones shot up underneath it and soon beyond it, making a grey and black canopy to the cone. So furious was the outburst that in a few seconds it was more than 3,000 feet above the summit. With our glasses we could easily discern the grey or white ash slipping in refts and avalanches down the side of the mountain peak caused either by the fall of stones or by the unceasing rain of pumice. This became thicker and thicker as the eruption went on, and soon a thick curtain of ash and smoke hung between us and the magnificent outline of Semeru. We listened for some distant thunderings from this fiery outbreak, but all was merged in the hoarse roaring and bubbling of Bromo in the valley below. I never shall forget the sublimity of the scene of the first explosion. The clear outline of the mountain, so bright in the early morning, its grand height and graceful proportions, and then the sudden disturbance of its calm repose by outbreak of ash, smoke, and fire until all was submerged in cloud, made it surely one of the grandest of natural phenomena.

The sight of this eruption rendered us more anxious to have a better view of the active crater near. We descended into the sand sea as already related. When we arrived on the level our state from dust and ash was rather ludicrous. The land beneath our feet was nearly of the uniform black hue which our faces, hands, and clothes had very soon assumed. But it was now a level plain that we were upon, and our course towards Bromo was easy and rapid. We were in a perfect amphitheatre of large dimensions. The walls around us were generally 500 and sometimes 1,000 feet high, apparently quite rugged and precipitous, except in one or two places. Their rough irregular outline, their varieties of colour, such as an old furnace wall or kiln might present, made them picturesque but wild and savage in aspect. It is in fact just like the walls of an immense smoked and blackened cauldron. No one

can have any difficulty in seeing that it cannot be so long ago since the sand sea was a seething mass of lava. This extinct outer crater or sand sea is almost 5 miles long by a mile and a-half or perhaps more at its widest part. It is probably a crater of subsidence, as the broken strata of the cliffs all round would seem to testify. To any one who would give the necessary expenditure of time, measurements would easily show what has been the former height and form of the cone.

We skirted round the hill or cone which occupies the centre of the sand sea, evidently a crater built up by a hasty and violent eruption. It is somewhat thickly clothed with wild oak, chestnut, and other trees, but in places the loose grey ash has been rather deeply scored by the rains. I should say that the hill was almost inaccessible, though Mr. Weld-Blundell offered to scale it within six hours if we would wait for him. Our guides assured us that no one had been on the top. It can, however, be scarcely over 1,000 feet above the level of the sand sea.

Having passed two-thirds round this cone we came to a well-built temporary attap tent, with a shed of the same material close by. Both of these were covered with half-withered adornments of flowers, coloured paper, red calico, &c. There were marks too of a rather extensive encampment. These were the remains of the annual festival held by the mountaineers in honour of the god Brama, after whom the mountain is named. Flowers, fruit, and wine are offered on the mountain, and then thrown into the crater as a peace offering. Music with various other festivities keep up the celebration for two or three days. They say that 10,000 people and more assemble in the sand sea on these occasions, including, strangely enough, many Mahometan Javanese, whose creed utterly condemns such rites.

Rising in a slope a short distance from this old camp were slopes and hillocks of grey ash, having much the appearance of hills of blown sand by the side of the ocean. Scattered over them irregularly were nodules of pumice and scorix, seldom larger than 2 inches in diameter. Some of these had been quite recently

ejected, showing that it is not always safe to be in the neighbourhood of the crater. After about half a-mile or so of gradually ascending hillocks of grey ash, the crater wall suddenly rises into a steep truncated cone, between 200 and 300 feet above the slope. It would be almost impossible to ascend so steep an incline of loose ash as fine as the finest dust ; but the Javanese have constructed for their own purpose a very simple and ingenious staircase or ladder of bamboo. By this means the side of the cone can be scaled without more difficulty than the fatigue of a long steep climb, via a ladder, where one-third of the rounds are wanting, making only steps or jumps, at times rather long. It is strange that this ladder, or a similar one, has been there from time immemorial. Dr. Horsfield saw it nearly 70 years ago. It is used by the priests at the annual sacrifice, at which period it is renewed or repaired. It needed considerable repair at the present time.

It would be difficult to convey an idea of the wintry, desolate aspect which this part of the crater presents. There is not a trace of vegetation. If here and there a weed or a blade of grass shows itself it is speedily covered by the fine, almost imperceptible, rain of dust and ash from the crater, which goes on for ever. The roar heard at the foot of the ladder makes one unaccustomed to it pause. There is nothing like it, unless the din and hoarse echoes of a huge steam factory ; but then the sharp crackling kind of bubble which shakes the ground and dominates all is peculiarly its own. The blue sulphurous fumes which are rising from the crater seem light and ethereal, as seen from below. From the rest-house they appeared dense and suffocating.

There were no stones or ashes falling on our side. Even the smoke and steam was blown by the wind to nearly the opposite margin ; but there was very little wind. The fumes rose up to a great height, and spread like a canopy before they were stirred at all. Up we went, having fastened our ponies to bamboo stakes which are left for the purpose at the foot of the ladder ; I forget how many steps there were, but I thought really that they never

would end before we were half way to the top. At length we stood upon the perilous brink, where a very necessary handrail a few yards long has been left by the considerate mountaineers. The sight at first is enough to make one dizzy. One looks down a funnel-shaped chasm about 500 feet deep, with an awfully steep incline. The sides are encrusted with yellow sulphur, and various huge stains of red, white and black. One sees also that much of what seems like smoke is in reality steam, for there are constant runnels of water flowing down the ash bank into the basin, and scoring the sides in every conceivable way. At the summit it is about one-third of a mile across; at the bottom about a third of that, or less. One part of the bottom is merely mud, from which steam bubbles rise. On the side beneath us there is a deep wide chasm, in which the smoke, ash, and steam conceal all but the blackened and sulphur-encrusted rim. From this comes the hoarse, deafening roar, which is really quite appalling. As the steam rises, much of the ash falls back from the cloud, giving the sides a weeping or combed-out appearance like a fountain of spray. All round the outlet the mud has formed a rim, which has spread from time to time, and then been cut down by the streams of condensed water. We tried to throw stones down into the pit. There were plenty of large fragments of scoriae to hand, but the ash was so fine and loose that, after rolling a short distance amid clouds of dust, the stones buried themselves and became immovable. Once or twice we fancied that we managed to sling a small stone into the opening and that the roar became louder; but we could not be sure of this, for nothing could be seen. The ash looks solid enough, but one sinks ankle deep into it, and every now and then it slides away from under the feet.

The opposite side to where we stood is much higher and forms a kind of peak, and then stretches away to form the sides of a larger but extinct crater to the south, Widaderen, or the abode of celestial nymphs. Like the other extinct cone (Butak, or the bald, though it is not bald now), neither of these cones has been in activity within historic times. I tried to walk round the rim of the crater to Widaderen, but had to give up the attempt. The

walk is so narrow that a very light puff of wind might take one over in either direction. Besides this, considerable masses of ash were continually slipping away, either down the steep exterior wall or into the crater. If an unfortunate pedestrian happened to slip with these avalanches of cinders he would scarcely reach the bottom without being suffocated. He might as well fall into a bin full of fine flour. If, however, he did reach the bottom alive, not "all the king's horses nor all the king's men" would pull him up again.

It does not appear that there is any great risk in ascending Bromo, yet the scattered stones around attest that at intervals the projectiles are flying up and down in a manner rather embarrassing to the peaceful sightseer. Once or twice we got just a little whiff of the sulphurous fumes of insufferable odour which on me at least produced the effect of violent coughing. They say that some visitors have paid the forfeit of their lives by approaching too near in times of unusual activity, but I could get no particulars. On the other hand, more than one European resident has assured me that the mountaineers have been known to descend to the bottom of the crater by means of rattan ropes. I am very incredulous about this. In the first place, I don't see how they could manage to make their way down the slope of fine ash, which, as I have said, is like flour, and in which even small stones were soon buried. In the next place, I don't see how any human being would find breathing air at the bottom of such a pit.

One can but speculate as to what makes the roaring noise at the bottom of the chasm. It sounds like the bubbling of some fierce incandescent mass. Yet I do not think that the molten matter can be very near. No doubt this volcano is connected with the great underground sea or lake of lava which has so many boisterous outlets for its stream and fires throughout the island. But the depth at which this liquid reservoir lies must be great, probable much below the sea level. This would make it perhaps two miles or more below the rise of the crater of Bromo. The orifice is, therefore, a kind of steam-pipe for the escape of pent-up

vapour. There has never been any large outflow of lava from this crater or any of its older portions. Ash, steam, and cinders have been the only ejectamenta during the greater part of its history. Melted lava might sometimes be forced up this sole narrow opening, but the force required to raise such a liquid volume would be great, and it is hard to suppose that it would stop there. As a matter of fact ash eruptions have been the rule, and lava the exception in the island of late years.

Measurements have shown that the floor of the crater is higher by over 100 feet than it was in 1845. This is easily accounted for by the accumulation of ash. Sometimes a perfect cone forms round the opening, but this is sure to be blown away in periods of more violent activity. It is at such times that the crater is dangerous to approach. With the exception of such occasional paroxysms it does not appear that there has been of late years any extra violence manifested by the volcano.

I must say that there is something disappointing in the aspect of this volcano. One expects to see a little of the ocean of fire at the bottom of the pit from which steam and ashes are emitted with such a roaring noise; but instead a chasm is all that is dimly visible through the refts in the vapour. But it is always so when such perilous phenomena can be inspected at all. Were the sea of fire boiling with its fierce glow at the bottom of the crater, one dare not even approach its foot, much less stand upon its brink. So we must be content with craters as we find them.

It was an easy journey down to the embankment, where we had good reason to be thankful for the homely shelter which the votaries of Brama afforded us. Here we camped in peace and security, watching the glorious tints of sunset over this strange and wild scene. There is nothing to remain all night for. The crater is not lit up with any glow. The mist, which after nightfall spreads like a curtain over the valley, does not even grant one the luxury of a star-lit sky. But the roar of the crater through the darkness of the night fills one with as much awe as the heavens with their silent eloquence.

VOLCANIC ERUPTIONS.—The history of terrible eruptions and volcanic catastrophes in Java would make a book in itself, while the destruction of life and property on a large scale in different parts of the island have been awfully frequent. In October, 1822, a crater close to Papandayang burst out with such suddenness into eruption that deep night seemed to come without warning upon the midst of a hot summer's day. The darkness was accompanied with a deluge of hot water and mud which spouted out, sweeping all before it, and causing fearful devastation amid animal and vegetable life for miles around. The ashes and stones covered the ground even 40 miles away. But strange to say the eruption only lasted a few hours and then all was still for four days. Just as the people were recovering from their terror the mountain burst forth into activity again, beginning with a violent earthquake which broke down the mountain, leaving in its place an enormous incomplete crater. The deluges of mud and stone reappeared, but this time with great blocks of basalt which were carried many miles away. The whole face of nature was changed in consequence, for there was no record of any previous activity in this crater, and a dense jungle forest covered the whole area. Over 100 villages were destroyed, and about 4,000 persons are supposed to have perished.

Equally terrible earthquakes are recorded; as, for instance, one in Batavia in 1699, and another quite recently in Jokiakarta and the neighbourhood, sacrificing thousands of lives. This was in 1867. But probably the most awful catastrophe of which there is any record in Java is that of Krakatoa, in the Straits of Sunda, which took place on August 27th, 1883. I was in Java at this time, though not in the immediate neighbourhood of the volcano; yet I saw many of the terrible evidences of its disastrous effects.

The crater of Krakatoa, which is on an island about 25 miles from the west end of Java, and 14 from the south of Sumatra, has been in a kind of smouldering activity as long as the island has been known to Europeans. In May, 1883, it broke out into activity, sending forth showers of ashes, stones, and mud, accompanied with violent explosions. These phenomena gradually

increased in severity till the beginning of August, when the country for 100 miles and more began to be covered with the ashes. On Sunday, the 27th, Batavia was rendered quite dark, while the explosions were so loud as to be heard in some directions nearly 1,000 miles distant. An immense amount of material was thrown up, and this, no doubt, was causing a stupendous cavity in the crater. At 2 a.m. on Monday the crater collapsed, and subsided with a roaring noise of such terrific intensity as to defy all attempt at description. The regurgitation of the sea into the crater caused two tidal waves 80 or 90 feet high to break upon the coast of Java, utterly devastating the country, destroying many towns and villages, and sweeping over 50,000 people into eternity. Such a catastrophe has no parallel in modern history. The whole coast of western Java was changed beyond recognition: roads, light-houses, and buildings of all kinds disappeared, while at Krakatoa the sea over one part of the crater is more than 100 fathoms in depth. The portions of the ancient cone which remain form broken, detached, rocky islands, quite different from their former position and shape, so that a new survey of the locality became immediately necessary.

The former condition of Krakatoa was that it consisted of one large island, whose greatest diameter was nearly north and south, with a high volcanic cone on the south end. At each side of its northern termination, almost touching it, were two smaller islands, Verlatan and Lang. At present Krakatoa has disappeared, except the peak at the south end of the island, which has been bisected by the subsidence, leaving a precipice over 1000 feet high, formed of ash and scorix, with the usual volcanic ejectamenta which form the highest side of craters; what little is left of the island now has its greatest diameter from east to west, with soundings of from 102 to 106 fathoms on its north-east side. Verlatan and Lang Islands still exist in the same positions and about the same dimensions, but Verlatan is surrounded with a number of rocks, reefs, and shoals on the side of the former site of Krakatoa. The soundings hereabouts are otherwise the same; but there is a general subsidence of the sea-

bottom around the island in the directions of Sumatra and Java, giving depths of 60 and 80 fathoms, where formerly 40 to 50 fathoms was the extreme. A mile south of Krakatoa 126 fathoms were obtained, where 80 was the former record.

HOT SPRINGS.—As might naturally be expected, the hot springs and wells of Java present most interesting phenomena. At Surabaya, in the midst of the alluvial flats, there is a petroleum well which, I think, like many others of its kind, is connected with immense deposits of drift-wood in the mud beneath. The hot springs and mud springs are numerous, but especially worthy of mention are those of Grobogan, situated about 30 miles east in a straight line from Samarang. They are seldom visited by travellers, but deserve careful investigation. The most convenient way to reach them is to go by railway from Samarang to the Gundik station, from whence there is a fair road due north $15\frac{1}{2}$ miles to Purwodadi, one of the important towns of the province of Japara. Five miles more of a carriage road brings one to Grobogan, a village or campong to the south of a small east and west limestone range. In the valleys between the spurs from this range on the south side there are many hot springs emitting both mud and steam. About the centre of the range is a mud geyser which in Horsfield's time emitted periodical explosions of mud and steam, but is much more intermittent in character now. Horsfield's description is as follows:—

“About the centre of this limestone district is found an extraordinary volcanic phenomenon. On approaching it from a distance it is first discovered by large volumes of smoke rising and disappearing at intervals of a few seconds, resembling the vapours arising from a violent surf; while a dull noise is heard like that of distant thunder. Having advanced so near that the vision is no longer impeded by the smoke, a large hemispherical mass is observed, consisting of black earth mixed with water, about 16 feet in diameter, rising to the height of 20 or 30 feet, in a perfectly regular manner and as it were pushed up by force beneath, which suddenly explodes with a dull noise, and scatters about a

volume of black mud in every direction. After an interval of a few seconds the hemispherical body of mud or earth rises and explodes again. This volcanic ebullition goes on uninterruptedly, throwing up a globular body of mud and dispersing it with violence through the neighbouring plain. The spot where the ebullition occurs is nearly circular and perfectly level. It is covered only with the earthy particles impregnated with salt water which are thrown up from below. Its circumference may be estimated at about half an English mile. In order to conduct the salt water to the circumference, small passages or gutters are made in the loose muddy earth, which convey it to the borders, where it is collected in holes dug in the ground for the purpose of evaporation. A strong, pungent, sulphurous smell, somewhat resembling that of earth-oil, is perceived on standing near the explosion, and the mud recently thrown up, possesses a degree of heat exceeding that of the surrounding atmosphere. During the rainy season these explosions are more violent, the mud is thrown up much higher, and the noise heard at a greater distance. This volcanic phenomenon is situated near the centre of the large plain, and the large series of volcanoes, and owes its origin to the general cause of the numerous volcanic eruptions which occur in the island." (Transactions of the Batavian Society of Arts and Sciences, Vol. IX.). This singular phenomenon is known to the Javanese under the name of Kuwu, as is also the village of salt-makers near it. In Javanese the word simply means "place of abode." But in Javanese legend the eruption is supposed to be produced by a fabulous monster snake, of which the place is supposed to be the dwelling. Grobogan was also the seat of the ancient Javanese kingdom." (Crawford's Descriptive Dictionary of the Indian Islands, p. 146).

In concluding this brief notice of the physical structure of Java it may be stated that, beyond all comparison, it is the most interesting and attractive island of the Indian Archipelago. The immense height and rugged character of its mountains give its scenery a sublime beauty. The almost exclusively volcanic soils make a vegetation of incomparable luxuriance. On this account

a wild stony character is imparted to by far the greater portion of the island, but the remainder or the alluvial plains have a richness with which no country in the world can vie. Thus it is able to support an enormous population for so small an island, there being 19 or 20 millions on the soil, and extreme poverty is a thing unknown.

CLIMATE.—The climate of Java is easily described ; being in the monsoon region of the tropics the seasons succeed one another with perfect regularity, alternating between the north-west and south-west monsoons. The first of these is the rainy season which averages about 90 inches per annum, though in particular situations, especially where the climate is modified by the mountains, it is greater or less as in other lands. The temperature seldom rises to 90° and during the day on the plains is about 85° in the shade. Speaking from my own experience, I found the heat of Java more bearable than any portion of India or the Indian Archipelago. I believe it is unhealthy, solely on account of the bad systems or no-systems of drainage. The open and foul ditches interlacing the most crowded thoroughfares of Surabaya and Samarang not only account for the insalubrity of the places, but make one marvel that they are not much worse. But Europeans are scarcely able to cope with the apathy of orientals on the subject of sanitary precautions.

The convenience of having almost a temperate climate within easy reach is found on the slopes or plateaux of the numerous mountain elevations. In this way Java is enabled to have a supply of European vegetables, a luxury unknown almost in any of the other portions of the Indian Archipelago. About 5,000 feet above the level of the sea the slopes of countless valleys on the Tengger and Semeru are covered with extensive kitchen-gardens in which cabbages of every variety, lettuces, potatoes, peas, beans, cucumbers, turnips, &c., are found in great luxuriance. The Tengger is also used as a sanatorium for European colonists ; the Javanese, like most orientals, do not take kindly to climbing mountains. As a rule the climates at this elevation are chilly,

foggy and damp. I found the mountain regions always depressing, especially as in these latitudes the sun is seldom seen at such elevations. It is rarely also, one gets a glimpse at the plains below.

VEGETATION.—Only a few words can be here devoted to the vegetation of Java, as to attempt to enter into any detail would be quite disproportionate to this essay. In brief it may be said that Java is, in the main characters of its flora, like the whole of the Indian Archipelago. On the coast are found the dense mangrove forests (*Bruguiera*, *Rhizophora* &c.). In the plains cultivation leaves but little to the indigenous flora. Useful palms are introduced, fruit trees, such as mangoes, mangosteens, durians, bread-fruit, jack-fruit, custard-apples, rambi, rambutan, guavas, jambosa, pine-apples, and last not least, every variety of plantain and banana. I do not refer to the cultivation which includes coffee, tea, quinine, indigo, sugar, Betel-pepper, pepper, spices generally, cotton, sweet potatoes, tobacco, and earth-nuts, and rice in enormous quantities yet not sufficient for the home consumption.

On the higher slopes of the mountain the jungle commences, with fig-trees, dipterocarpaceous forests interspersed with oaks, chestnuts, the copal tree, a huge king of the forest attaining 150 feet high, and 10 or 12 feet at the bole. This is called by the Malays Dammar and hence the botanical name *Dammara orientalis*, Lambert. The timber is of little value, but it produces a fine transparent resin which deeply coats the ground for yards around and hangs like icicles about the stem, being a source of profit to the natives. The forests in these higher regions are thickly matted together by creepers, vines, climbing palms and aroids of every sort and size, the natural order Melastomaceæ having the largest number of representatives (*Melastoma*, *Medinilla* *Sonerila*, &c.). Underneath the trees the shade is thick, making a greenish twilight in which immense tree-ferns and large ferns of the genera *Marattia*, *Angiopteris* and *Matonia*, combined with innumerable other cryptogams cover the ground, while orchids in multitudes of individuals and species cling to the branches and stems of the trees.

The smaller flowers carpet the earth still closer to the ground, including *Didymocarpus*, *Begonia*, *Selaginella*, *Caladium*, *Maranta*, with luxuriant mosses and lichens.

Between six and seven thousand feet the forests cease, and grasses, ferns and stunted trees are irregularly scattered over the ash deposits. I remember being much struck at seeing groves of *Casuarina littoralis* on the road sides of Tengger at about 6,000 feet of elevation; but I think these trees must have been introduced; they are indigenous on the coast in many parts of the Indian Archipelago. On this treeless region some alpine plants are found such as *Rhododendron*, *Vaccinium*, and a pink primrose (*Primula imperialis*), which was once exclusively confined to Mount Papandayong, but is now found elsewhere as a result of cultivation. The *Nepenthes* or pitcher plants are found in similar localities.

The Javanese flora has an advantage over that of most of the Archipelago, in being nearly completely known. Horsfield, Blume, Miquel, Grevelink, Filet, Teysmann, Binnendijk, Kurz, Wallich, Jack and others have celebrated and described its beauties and richness in costly publications, some richly illustrated.

ZOOLOGY.—The natural history of Java is rich and peculiar. The majority of its mammalia, which Wallace supposes to number about 90 distinct kinds, are identical with those of Sumatra and Borneo; but Java has no tapir, elephant, Malay bear, or orang-utan. The Javanese rhinoceros and hare are identical with species found in Indo-China. Of 240 species of land-birds 40 are not known out of Java, while some of the common and characteristic Indian birds, such as Indian magpies (*Dendrocitta*), the green gaper (*Calypptomena*), the bearded roller (*Nyctiornis*), the argus pheasant, the fire-backed pheasant, and the crested partridge are not known in the island. "On the other hand, there are twelve Javan birds whose nearest allies (sometimes the identical species) occur in the Indo-Chinese countries or the Himalayas, while they are quite unknown in Sumatra and Borneo,

the most popular example of which is the pea-fowl of Java, found also in Siam and Burmah, but not in the intervening islands.”* “Two species of jungle-fowl inhabit the island, one not known further eastward than Sumbawa, the other supposed to be the original stock of all domestic poultry. There is a peacock and several species of partridge and quail, and some very beautiful pigeons, pre-eminent among which is the mountain fruit-dove (*Ptilopus roseicollis*), whose entire head and neck are of an intense rosy pink, contrasting exquisitely with its otherwise green plumage.”

The wild animals are very numerous, especially on the lower slopes of the eastern end of Java. Tigers are dangerously abundant there, as well as leopards and black panthers, the latter being only a black variety of the leopard. The rhinoceros is common on the marshy lands at both sides of the island, there being two species; but, strange to say, one of them (*Rhinoceros javanicus*) is not found in other typical Malayan regions, though it reappears in the Indo-Chinese countries. The elephant is not wild, nor is it used as a beast of burden. As might be expected in a country where beasts of prey are so numerous, game is abundant too. There are many species of deer in the woods, besides a wild ox and two species of wild swine. Monkeys of several kinds are well represented, principally Gibbons, Macaques, and *Semnopithecus*. In the western and central parts of the island crowds of the latter are seen passing from tree to tree with great rapidity, chattering as they subsist on the wild fruits. The orang-utan, as already stated, is unknown. There is a wild dog, as in the Malay Peninsula, probably the same species; and a fruit-eating bat of large size, whose habits are scarcely nocturnal, nor is it so gregarious as the species of flying-fox so well known in Australia.

*I take these facts generally from the Dutch naturalists as given by Wallace in his “Geographical Distribution of Animals,” Vol. I., p. 349. Being no sportsman, my knowledge of the avi-fauna of Java is entirely derived from books and museums, but I regret to add there were no public collections in Java up to 1875.

ETHNOLOGY.—There are in Java many different kingdoms, but principally three well-defined and distinct races—namely, the Sundanese on the west, the Jawa or Javanese in the centre, and the Madurese on the east, in the island of that name. In the eastern end of Java also, about Banjuwangi, there is a considerable admixture of Balinese from the neighbouring island of Bali. These races have fairly marked characters, though it requires a long residence and experience for a European to distinguish them. The following are the impressions made upon me:—The Sundanese are slight and graceful, with lighter complexions and particularly mild expression of countenance. The Javanese are short of stature, with the Malay projecting lips and flattened upturned noses strongly marked. The Madurese are a very swarthy, muscular race, evidently well fitted for labour and strength, for which they bear a reputation.

Formerly Java was divided into important kingdoms, some portions of the history of which combine with those of the world of latter times. Originally founded with an advanced civilization from the Indian peninsula, they were converted in the 15th century from Buddhism or Brahminism to Islamism by Arab missionaries. Ever since the Arabs have been somewhat largely domiciled in the island, and an Arab element is engrafted on the language. Annual pilgrimages to Mecca serve to keep up these relations.

At present all the native princes, the king of Jokiakarta and emperor of Solo are under the dominion of the Dutch, who administer their kingdoms for them and give them a liberal maintenance. The splendours of these oriental courts are perhaps as great as ever they were, with all the gaudy adornment, bright coloured silks, birds' feathers, golden umbrellas, and a moderate proportion of gold, silver and precious stones. The pageantry of these relics of the past is mostly interesting to the student and the antiquarian. The rajahs may be distinguished by a pleasing and amiable exterior of marked Indian characters, while their mild-eyed crowds of attendants have the spiritless yet kind look of all the Javanese. Everywhere one meets with courtesy and more marks of respect than in any other part of Malaysia.

The Arabs and Chinese are made to reside in certain parts of every town where they are sufficiently numerous. They are under a captain of their own countrymen who is responsible to the government for their good behaviour. They are confined to certain provinces, outside of which they are not allowed to travel without a special permit. An ex-Resident told me that he had never once given this permission during all the time of his administration. The Chinese and Arabs are under many restrictions, but the former may be said to have all the business of the country in their hands. No native prince or rajah can vie with the splendours of the establishments of certain Chinese merchants of Batavia, Surabaya and Samarang.

Altogether the dense population of Java and its various nationalities are as contented and prosperous as any in the world. The Dutch have done wonders for the island. Splendid roads and various other advantages of cultivation make it a garden of utility and beauty, far in advance of every island in the Archipelago. Having seen the most of them, I know none that can be in any way compared with it.

LANGUAGES.—There are principally three languages in Java besides, on the coast, a certain amount of Malay, which, as Mr. Crawford said years ago, is truly the Italian of the East. The native languages are those of Sunda, Java proper and Madura. The Sundanese is spoken by the inhabitants of the mountainous districts of Java west and south-west of Tegal; the Jawa or Javan belongs to the centre of the island and is met with east of Cheribon; the Madurese belongs to that island, and the people who have emigrated therefrom. These languages with that of Bali, Lampong (Sumatra) and Malay, are all dialects of one tongue of which the roots are said to be invariably Sanskrit. The Javanese possess further a classic language or language of literature distinct from the ordinary language of the country. There is a somewhat extensive literature connected with it. It has an alphabet from which the alphabet in use is derived. It is written from left to right and is the same in Madura and Bali. In Java

they write with Indian ink, but in Bali the natives use an iron style and cut letters on a *Borassus* palm leaf, cabbage palm or *Pandanus* in the same manner as in western India. The leaves are about two inches wide and 18 inches long, and are strung together like a Venetian blind. The letters are formed with the utmost neatness, and together with the illustrations form interesting and valuable records.

It is supposed by Crawford that the Sundanese dialect is the most ancient, and probably contains many of the elements of the aboriginal language found amongst the tribes which were conquered by the Hindoos when they established themselves in the island. It may be mentioned also that the Arab elements in the language are confined to less than 100 words, and these mostly terms connected with articles of trade and commerce. The Malay, used as a means of communication between the different nationalities on the coast, differs slightly from the Malay of the Peninsula.

RELIGION AND ANTIQUITIES.—The Javanese profess the Mahometan religion, but mixed up with a good deal of old traditions and superstitions of their former belief. Thus they readily make offerings of flowers and fruits to the idols of Siva, Vishnu, Brahma, and Ganesha, which are still to be found abundantly scattered amongst the ruins of temples in various parts of the island. They do not adhere to the Islam rule of abstaining from stimulants, though they are a temperate race. In this respect the Malay races are remarkably superior to the Hindoos.

The ruins which are found in Java are monuments of great beauty and excellence. The best are at Brambanan, Singosari and Borobodor, besides the whole of the valley of the countries around Borobodor already referred to. A wonderfully detailed history of ancient Java, its manners and customs, could be gathered from the skilful carvings on the entablatures of the ruins. They are mostly from 400 to 500 years old. There are also still more ancient ruins found in various parts of Java; in fact the whole country is rich in oriental antiquities. As usual in such cases it is disputed whether the worship represented in these remains is

that of Brahma, Buddha, or Jain. The best investigations on the subject are shut from the knowledge of mankind by being enshrined in the mysteries of the Dutch language.

This completes my notes on the geography of Java, made during lengthened visits, traversing the island from east to west ; and, secondly, returning overland from Batavia to Samarang, and thence to Brambanan for a detailed examination of the ruins which I had hurriedly passed by on a former occasion. I also made two journeys through the Sundanese country, taking in all the important towns and objects of interest. I had letters of recommendation to the Governor, but except calling on His Excellency and on one or two of the Residents, all my journeys and investigations were conducted at my own expense. The best season for visiting Java is just before the break-up of the south-west monsoon in August and September.

BANKA AND BINTANG.

After my first visit to Java in 1883, my intention was to explore some portions of the Malay Peninsula. Leaving Batavia I proceeded across the Straits of Sunda to the Straits of Banka, spending a short time at Muntok, the principal town on the island of Banka. This island lies just north of the equator at the south-eastern end of the island of Sumatra, from which it is only separated by a narrow strait. The extent is 120 by 60, with an area of 3568 geographical miles. A low mountain chain, whose highest point is Mount Maras (2000 feet above the sea) runs through the whole island. The rock-formation is granite, giving rise to a barren soil ; but yet the country is covered with a dense forest and jungle, mingled with swamps and small streams only navigable for native craft. The island is very rich in alluvial deposits of tin, iron, and native gold. On the edge of the coast I noticed here and there lying upon the granite outliers a palæozoic formation with schists, slates, flagstones, quartzites, and a little limestone, all much metamorphosed and very rich in iron. The decomposition of this rock gives rise to highly ferru-

ginous beds, which English people are accustomed to distinguish generally by the name of laterite. It is at the junction of these beds with the granite that the rich deposits of alluvial tin occur. Banka and the neighbouring island Biliton have long been famous for their rich mines of stream tin ; but there are no veins. This forms the great export of these islands, from which the Dutch derive very large revenues. The tin mines of Biliton and Banka used to be considered the largest as well as the richest in the world ; but probably they are equalled, if not surpassed, by those of Perak.

But another great source of revenue to the island of Banka is from the export of two kinds of timber, namely, Agila and Belian. Agila or eagle-wood (*Aquilaria agallocha*, L.) has been from time immemorial imported by the western nations from the East, and is supposed to be the "Aloes-wood" of Scripture. It is burnt like incense, but is also much used as the source of a perfume extracted from its resin. That exported from Banka is considered amongst the best. Belian (*Eusideroxylon zwageri*, T. and B.) is the iron-wood of commerce, belonging to the laurel family, and being found in abundance on this island, though it is also known from Sumatra and Borneo. I have seen trees likewise in the northern part of Celebes. The wood is of extraordinary hardness and durability, and is said to resist the white ant, which I question. At any rate it is considered a most valuable export, and adds much to the revenue of the island. The wood is exported in long beams, sawn to about 6 inches square. Muntok, the port of Banka, is opposite to the great alluvial delta of the Palembang river in Sumatra.

From Banka I proceeded to Bintang, the largest island of an archipelago between Singapore and Sumatra. It has an area of 3,336 geographical miles. It is a granitic formation with a low mountain chain like Banka, whose highest portion is only 1,368 feet above the level of the sea. On the western side, divided from Singapore by a narrow strait, is the Dutch settlement of Rhio whence twice a month steamers leave for Delli, the great tobacco district of central Sumatra. The geological formation is

the same as Banka ; but I am under the impression that there is a recent development of volcanic rocks which is not seen in other parts of the archipelago. It should be here mentioned that the so-called laterite formation gives rise to a fiery red soil, which is especially characteristic of these lands. The rocks are red, and so are all the roads of most parts of the Straits Settlements anywhere near the coast. This imparts great variety and brilliancy to the scenery.

STRAITS SETTLEMENTS.

From Bintang, the name of which in Malay signifies a star, I crossed to the Straits Settlements, remaining at Singapore for some time. During this period I went completely round the island, and in this and several other journeys made a more or less complete examination of its geology and that of the neighbouring state of Johore. The voyage round Singapore is one that can be easily made by steam in a few hours. It is an exceedingly picturesque journey through a narrow strait, bordered by low lands and rocky islands, varied in the most charming manner by the brilliant colours of the rocks already referred to. The vegetation even down to the water's edge is unusually luxuriant, either tropical jungle or plantations of coffee, cotton, tea, gambia and pepper, bordered by cocoa-nut and Betel-palms.

MALACCA.—In my first journey I left Singapore at the end of October 1883, and visited the ancient city of Malacca, a city which, even more than the well-known kingdom of Java, is connected with all the historical associations of the Indian Archipelago. The Portuguese, the Dutch and the English have all left amid the ruins of this curious eastern capital, some relics and memorials of their former history. Of the many churches, public buildings, monasteries and the large college, only one solitary ruin remains now, though heaps of stones and inscribed tombs, tell their own tales in quaint old Latin epitaphs, some nearly 300 years old. This is the scene of some of the most heroic labours of St. Francis

Xavier, and here his body for some short time found a sepulture. The old streets and suburbs of Malacca contain many an historic record. There is no place out of Java which so well repays attentive examination.

PENANG.—From Malacca I went to Penang, the seaport next in importance to Singapore and then the most northerly of the Straits Settlements. It is one of the most purely Chinese colonies, though the city and all its surroundings have been much modified by European, or say British, influence. Penang and the opposite province of Wellesly on the mainland are thriving colonies supporting a large population of industrious well-to-do people. I paid many visits to Penang in my journeys backwards and forwards. It was one of the central points of my travels to which I repeatedly returned. To the north of the province of Wellesly is the native state of Keddah, divided from the province by the river Salama. Twice I made boat expeditions up this river as far as Salama. This village may be called a Sumatran colony settled here for the purpose of mining for tin, which is very abundant. In one of my visits to this village I had the misfortune to witness the loss of a boatman's life through his having been carried off by a tiger.

PERAK.

After a short stay at Penang at the time of my first visit, I returned south to the native state of Perak, then under the administration of Sir Hugh Low. The port of entry was Matang, a low-lying mangrove swamp of the most unwholesome surroundings, and connected with the capital by a well-made road eight miles in length. Since that time, (1883) a railway connects the capital with Port Weld, a better harbour slightly nearer to Penang. Thaiping was then the capital, a Chinese mining town of about 10,000 inhabitants. It was well laid out in fine wide straight streets, in which the light sordid-looking bamboo shops and houses were rapidly being displaced by solid brick tenements. The old capital of Perak, or, at any rate, the residence of the

rajahs was at the mouth of the Kangsa river at its junction with the river Perak. To this there was a good metalled road about 23 miles in length from Matang. This road was made through a low pass in a range of mountains running north and south, and dividing the valley of the Perak from the sea-coast. Kuala Kangsa was the residence of Sir Hugh Low.

I remained a longer time in the native state of Perak than in any other locality during the whole course of my travels; but I was not resident for more than a few weeks at a time, at each place. Thaiping was my central point, returning to and fro as each exploration was completed. When I say exploration, I do not mean the examination of places which Europeans had never visited before, for this did not often fall to my lot, but the geological and zoological exploration, as well as making botanical and zoological collections in nearly every place where I stayed.

It would be confusing if I were to attempt to follow a chronological order in the journeys made, so I must content myself with merely stating what were the places or districts visited in the course of my travels.

One of the first expeditions was in a large canoe down the river Perak, as far as its junction with the Kinta, and then, by means of this river, exploring much of the interior of the country drained by tributaries of the Perak. There is a range of mountains between the river Perak and the sea-coast, and both the range and the river pursue a nearly north and south direction. The eastern side of the valley of the Perak is a detached range of mountains, dividing the Kinta from the Perak; and where this range terminates to the southward the Kinta joins the Perak, and they form one stream for about 40 miles where the Perak discharges into the ocean. Almost opposite to its mouth is the group of islands known as the "Dindings," amidst which I remained dredging for some time.

I left my canoe at the junction of the Kinta, and proceeded up the latter river in a small steam-launch belonging to the Perak Government. This effected a great economy in time, as the

usual mode of progression up rivers is by "poling," an exceedingly tedious method, which sometimes barely exceeds a mile an hour. My first resting place was at the old village of Kota Baru (New Fort), which was the central village of the district, and where the local magistrate or resident commissioner lives. The place, however, was nearly abandoned, owing to the floods in the river and the consequent prevalence of fever. A new settlement has since been formed at Batu Gadjah, about six miles further up the river by land and 14 miles by water. From the new settlement Mr. Hewett, the local magistrate, sent a boat with four Malays, who in five hours poled us up to the station. The site of the town had just been cleared of jungle and was being surveyed. As an instance of the inconveniences to which Europeans are exposed, I may mention that the survey was being conducted by a gentleman who had brought his family with him. When the river overflowed everybody but himself got fever, and one of his daughters died. At the time of my visit there were 70 Chinese and Hindoo patients in the hospital of Kota Baru laid up with Beriberi fever. I am happy to add that the newly chosen station is much more healthy.

My journey from Batu Gadjah was continued on elephants. The first stage was to Poussen mines, distant three and a half miles, where Malays were working shallow tin deposits. The tin occurred in an alluvial drift contained in pockets and pot-holes, in a much eroded crystalline limestone, which still retained traces of stratification. This limestone was either covered by a river gravel or cropped out in pinnacles and blocks. Here was also seen the only dyke of recent trap-rock observed by me in this part of the Malay Peninsula. At Pappan, four and a half miles from Batu Gadjah, large tin mines were in operation, at least an opening was being made by a European company formed in Shanghai. The place had formerly been extensively mined by the Malays, and the former workings, now filled with water, bear curious testimony to the extensive nature of the deposit. Much of this country, extending over a large area, has been mined in former times by the Malays, and some of the operations date back

to considerable antiquity. In the valley of the Kinta the country is singularly diversified by outcrops of crystalline limestone, which are outliers of an ancient formation, traces of which are found to extend through the whole of the Archipelago, and through Borneo and Pulawan into the Philippine group. In the valley of the Perak there are also limestone outliers, but not so numerous. One notable precipitous hill, named Pondok, occurs in the pass between the sea coast and Kuala Kangsa. It is a gigantic rock of quite precipitous character, about 1,500 feet high. From Pappan I crossed a mountain track to Lahat, where the engineer and manager of a French mining company resided. He had cleared a small hill of jungle, from which a magnificent view could be obtained of the surrounding country. Ranges of mountains 5,000 to 9,000 feet high could be seen to the eastward, fronted by limestone hills 1,500 feet or so in height. From Lahat I crossed to the river Raya on elephants, partly through swamps, partly along the bed of a river, and partly through jungle. From this river a good open road enabled me to reach the village of Tecca, and then the extensive mining town of Goping. From this I returned to Kota Baru, and then in the steam-gig went down the Kinta to the Kampar River, along which I poled as far as the river Diepang, at the foot of the mountains. Here in precipitous limestone cliffs there were tin mines, worked in alluvial earth and limestone caves. This alluvium was some hundreds of feet above the present level of the valley, showing that there had been extensive denudation. This was my farthest point in the interior of the peninsula on the west side of the range, and from thence I proceeded down the river Perak to the Dindings. In all I travelled between 180 and 190 miles on the river Perak, the farthest north being at Enggor, an alluvial tin mine worked by Chinese, about eight miles up the river, and a little way back from the banks.

Besides these journeys through the tin mining district in the state of Perak, I remained on the mountains in different parts of the state, botanizing, collecting and making a series of observations connected with meteorology, heights of clouds, &c. The first of

these stations was at Maxwell's Hill, as it is called, a sanatorium on the summit of a mountain only three miles in a straight line from Thaiping, but over three thousand feet above it. I remained about a month at this station. I subsequently removed to another mountain called Arang Para in the pass between Matang and Kuala Kangsa, and about the same height as Maxwell's Hill, but a better situation in many respects for observation. The bunga-low is situated on the highest point of a spur, dependent upon a much higher mountain, namely Gunong Bubu, probably about 6,000 feet above the level of the sea. This mountain had never been visited by Europeans, being separated from the settled districts by several miles of dense jungle, and almost precipitous ridges and ravines. Assisted by Messrs. Bozzolo and Scortechini, I explored to the summit of this mountain, occupying myself in the examination of the country, and camping in the jungle for a couple of weeks. Several very interesting botanical and zoological observations resulted from this journey, not the least of which, was the discovery of a mountain flora similar to Mount Ophir in Malacca and some of the mountains of Borneo and Sumatra.

To the north of Thaiping along the coast in the direction of Province Wellesly, much of the alluvial flats and mangrove swamps has been reclaimed for the purpose of sugar-plantation. Some of these I also visited at the mouths of the rivers Krau, &c. The whole of the western coast-line of the state of Perak is almost entirely a low-lying mangrove shore, of very shallow muddy water, with dense jungle or lalang (*Imperata arundinacea*) scarcely raised above the level of the sea. Matang is at the mouth of the river Larut, and there are several other small rivers such as the Johore, the Limou, the Trong, &c. I visited many of these, as well as some of the long stretches of muddy islands which front the coast. To the south one river, a little longer than the rest, is called the Bruas. This river is mainly distinguished for the enormous number of crocodiles which it shelters. The mud is almost alive with them, and I have never seen such numbers, or such large crocodiles in any other place in the whole course of my travels.

SELANGORE, SUNGEI UJONG, &c.—Next to the state of Perak, to the northward is the state of Keddah, which was not under British protection at the time of my visit, but is a tributary of Siam. To the south of Perak is the native state of Selangore, an important territory which is under British protection. This state I visited and travelled through to some extent, but not so fully as the state of Perak. The Sultan of Selangore holds his court at Jugra, a native town with a thoroughly Malay agricultural population about it. The principal towns are in the mining districts on the river Klang ; one being named after the river and was formerly the native capital, but is now far eclipsed by the centre of mining industry named Kuala Lumpur, which is the seat of British government and supports a numerous and wealthy Chinese population. The country around is singularly picturesque and beautiful, and this is owing to the extensive development of limestone formation which forms outliers on the granite. These are weathered into pinnacles and castellated outcrops like ruins of grand and varied shape. Within a few miles of Kuala Lumpur are limestone caves of large extent and magnificent beauty, from the colour and form of the stalactites. They form one of the most remarkable natural curiosities of the peninsula, though there are many other caves to be found in the limestone. To the south of the state of Selangore is that of Sungei Ujong which was a part of the territory I never visited. Beyond this was the state of Malacca, separated on the coast from Sungei Ujong by the river Linggi. I spent about six weeks in all, in the examination of the state of Malacca, living for a short time at several stations in the interior, as for instance at the hot springs (Ayer Panas) where the water bubbles out of the ground from the granite rock, at a temperature near to boiling, at Allor Gajah, where some 50 years ago we gained a victory over the Malays, at Gading where there are old tin mines, and finally I visited and examined the large mines at Chin-chin. The whole of this country is intersected by the most excellent roads, fit for any vehicle. Much of the north side of the state has been cleared of jungle and planted out by the Chinese in tapioca plantations or

manihot, for which the ground is eminently fitted. Pepper, rice, and sago, besides much cultivated fruit are extensively produced. The state of Malacca is now principally dependent on its agriculture as it produces but little tin, and has no more than the name of producing gold. I have traversed its roads from Sungei Baru on the west to Sungei Kesang on the east, and from Malacca to Mount Ophir, and I found it, next to Java, the most civilized besides being the most picturesque part of the Indian Archipelago, but the scenery is of a subdued rural description compared with Perak.

PAHANG.—On the east side of the Malay Peninsula my travels were more restricted, for the states in this portion of Malaysia are poorly populated and but little known. One reason for this is that the eastern side is exposed to the full force of the monsoon for six months of the year, when it blows up the Gulf of Siam. Thus the mouths of the rivers emptying on the east coast become absolutely closed to navigation. Yet a special interest attaches to this portion of the continent, because some of the states have had a great reputation from time immemorial for the production of gold. The Spanish author Manuel Godinho de Eredia, writing in the commencement of the seventeenth century, speaks of gold dust found at Jelli in the kingdom of Pam. This is the river Jellis in the kingdom of Pahang, the state next to the north of Johore, on the east side of the peninsula and about 250 miles from Singapore.

Although so near to Singapore, it is surprising how little was known of the kingdom of Pahang. Probably not more than a dozen Europeans have visited it at various times. Of late years more keen attention has been paid to its rumours of mineral riches. About five years ago a government surveyor from Selangore undertook on his own responsibility and at his own expense the survey of the river Pahang; and this he accomplished in a singularly accurate manner, considering the means at his disposal. In 1884, the river was explored by Mr. Scaife, and early in 1885 Mr. Swettenham the Government Resident at Selangore crossed the range between Kuala Lumpor and the Jellis, while the year before

Mr. Scaife had crossed from the Semanten to Kuala Lumpur on foot and accompanied only by a few Malays. In July 1885, I proceeded from Singapore to the Pahang river in company with Mr. Scaife and a Mr. James. We intended to explore the river as far as the gold mines by means of a small steam launch belonging to the gold-mining company that was just formed. Our intention was also to report upon the mines which had been already explored by Mr. Scaife.

On entering the river Pahang we found the channel to be extremely tortuous and difficult. The town of Pekan which is the sultan's residence and the capital of the state is about eight miles up the river. It is a large town with fewer Chinese inhabitants than is usual in these regions. Some of the houses are built upon rafts always floating in the river, but there is a good brick and stone mosque about the size of a small chapel. The sultan's palace is a more pretentious two-storied residence. In the centre of the town is a conspicuous shed, under which the principal nobility and government officers give all the vast resources of their intellects to top-spinning, often led by the sultan himself. The tops are the most effective things in tops outside of Japan, and in all the specialities and refinements of top-spinning they are second only to the Japanese. They can boast of having brought the industry to its highest degree of perfection, having spared nothing that labour or genius could bring to bear upon the subject. The importance of this speciality to the kingdom can be easily imagined.

As it was the fine season of the year, when the rains are comparatively light, the river was too low for our launch. Though only drawing three feet of water, we found it impossible to proceed, as we grounded almost every mile, even assisted by Malay pilots who knew the channel well. We lost more than three days in advancing about five miles. Then the sultan lent us a large canoe, with a crew of ten boatmen and a pilot. He also gave us a letter of recommendation to the different functionaries on the river, so that we could get help when we needed it. All these favours were only obtained after much delay, so that it was several days

before we could make a start. The stream was too rapid and shallow to advance in any other way than by poling. It took us from the 27th July until the 6th of August to reach the gold-mines. At about 70 miles, we left the Pahang and ascended the Jellis, and at 60 or 70 miles further reached the gold mines which were carefully examined. I found them to be very rich and of great extent. Small quantities of gold dust were being continually collected by the Malay villagers from the refuse heaps by the side of the quartz reefs. The appearances presented by the ancient workings were such, that I concluded that mining dated back for two or three centuries. Some of the marks of operations conducted there have a very ancient appearance.

Returning down the Jellis and Pahang to the junction of the Semanten I ascended the latter river for several days, reaching a few remote villages. I left the Semanten river at its junction with the Brentong—a river so much reduced and with such shallow rapids that this part of the journey was made in a small canoe. I ascended the Brentong as long as it was any way navigable, and having examined some poor tin deposits at the foot of the mountains, I returned down the river to Pekan, having been absent about six weeks, during the whole of which time, with the exception of one day, I was confined to the canoe. I found the Malays of Pahang to be a most interesting and simple race of people. They are agriculturalists, but extremely poor, so that we could scarcely obtain from them by purchase sufficient food for our wants. The coinage in use amongst them is small square pieces of tin. They are of the same form as those described by Tavernier, the French traveller, as having been in use in Keddah in 1677.* The details of my journey through Pahang are of the most interesting description, and I propose to give fuller details in a subsequent account which I hope to publish. Such collections as I was enabled to make confirmed what has already been partially known concerning the natural history of the country on the eastern

*Voyages de J. B. Tavernier, 2nd partie. Paris, 1677. *Traité des monnaies des Indes.*

side of the dividing range. The avi-fauna manifested a marked approach to that of China, and a slight variation from the Malayan sub-province of the oriental region.

The geology of the eastern side of the peninsula was also somewhat exceptional and remarkable. Instead of the universal prevalence of the granites and palæozoic schists, slates, and limestones of the western side of the divide, I found rather extensive outcrops of andesitic traps at about 70 miles from the coast, giving rise to subsidiary ranges of volcanic character and of moderate height; that is, from 1,500 to 2,000 feet. The physical features of the country were not only much modified by these ranges, but also, I believe, the flora and natural history as well. The gold mines were found to be geologically similar in age and character to those of Australia. The gold had been found originally in alluvial gravels, but latterly was derived from the breaking up and washing of large quartz reefs.

The flora did not differ materially from the general character of the Malayan vegetation, but the collections were not sufficiently extensive to determine whether there was a larger proportion of Chinese types than are usually met with on the west side of the divide. The species of forest trees, generally speaking, did not differ from those of Singapore, Malacca, &c, that is with a prevalence of fig-trees, *Dipterocarpus*, *Dryobalanops*, *Shorea*, *Hopea*, *Fagraea*, *Artocarpus*, *Eugenia*, *Jambosa*, *Sterculiads*, palms of the genera *Arenga*, *Licuala*, *Pinanga*, *Eugeissona*, *Borassus*, *Caryota*, *Areca*, and *Nipa*. Some of these are only cultivated. The river flora, moreover, seemed to be such as prevails throughout the whole Archipelago. The fresh-water mollusca differed but slightly from that of the western rivers. *Unio sub-trigonus* and *Unio delphinus* are as common in the river Pahang as at Malacca, and in both places are used considerably as articles of food by the natives.

BORNEO.

My travels in the Malay Peninsula had a long period of interruption in 1884, while I had the advantage of a cruise in Bornean and Sulu seas in one of Her Majesty's cruisers. It was thought desirable to collect accurate information for the Admiralty as to the various deposits of coal, of which there had been many discoveries in these islands. The acceptance of this commission gave me an opportunity which I had much desired of seeing the geology of this part of the Archipelago. I sailed in H.M.S. 'Pegasus' (Captain Bickford commanding), leaving Penang at the end of October. We passed close to Victory Island, a small peaked granite island about 150 miles from Singapore. On the third day also we passed the South Natuna Islands. Of these latter very little is known. They are inhabited by a peculiar Malayan people, or a mixture of Malay and Chinese, who are more than suspected of piracy when a chance offers. We were quite near enough to the land to see the houses and the clearings for cultivation, and even the men on the coral reefs spearing fish. There seemed to be a good deal of cultivation on the islands, which were prettily diversified with apparently volcanic peaks, and a dense tropical vegetation on some of the highest centres. The same evening we came in sight of the high land of Borneo.

LABUAN.—On the sixth day we reached Labuan, which had then a European population consisting of the Governor's family, the treasurer, and the gaoler with his family, in all about ten persons. At one time, when the coal mines were in operation, there was a larger population, but the mines have been abandoned for some years, and since then the place has been occupied by a small staff of government officials, a few Chinese merchants, and the Malay agriculturalists. The time of our arrival was somewhat opportune. The Sultan of Brunei had got himself into trouble with neighbouring tribes, who were killing his people under considerable provocation. He had asked the intervention of Governor Treacher, but while the Governor was trying

to arrange with the Sultan's enemies, who were quite peaceably disposed, the Sultan treacherously incited the wild Dyaks (Muruts) to attack them, so that seven people were killed, and the Governor himself put in some peril. So glaring an insult could hardly be passed over, so that immediately after our arrival the Governor formally applied for the assistance of Captain Bickford in obtaining at least an apology.

BRUNEI.—Accordingly we sailed at once for Brunei, the mouth of which river is about 40 miles from Labuan. There all the ship's boats were manned and armed, and an expedition of about sixty blue-jackets under Captain Bickford, accompanied the Governor to demand some redress from the sultan. We found the mouth of the river almost blocked up by a kind of breakwater, by which the river was barred against the Spaniards a century or two ago. The sultan's people did not take our demonstration very seriously, for his prime minister sent his launch to meet us and to assist in towing the boats; but he had his revenge, for we slept on board this boat, and I have never, in the moderate experience of a lifetime, seen a steam launch infested with so many cockroaches. Our boots were nearly eaten off our feet.

It was somewhat interesting to be upon the river described so graphically by Pigafetta nearly 400 years ago. There has not been much change since then. The river is broad, with high ridges of serrated hills on each side, and villages built over water on high piles. But the city itself was just as Pigafetta saw it: a sort of bamboo Venice, the streets and squares, the courts and palaces were all built in the midst of the water without any means of approach except by boats. I suppose there is no city in the world so peculiarly constructed. The origin of this mode of residence doubtless arose from the bad habits of the Brunei people. They were in reality sea-gipsies who had given the inhabitants of the land so much reason for complaint that they could not trust themselves unreservedly on the shore.

The officers of the sultan gave a private audience to us on the evening of our visit, receiving us with what may have been

intended as an honourable demonstration, but which looked like a reception by an armed rabble of very villainous-looking pirates. Every sort of excuse was invented to refuse the apology demanded. The next day the boats were brought up and the sultan admitted us to his august presence. The venerable potentate was 100 years old, and looked every hour of it. He was surrounded by an oriental court of truly theatrical splendour, presenting a scene of silks and satins, gold, silver, precious stones, feathers and tinsel unequalled anywhere. His Highness objected to make any reparation to the Governor, but the display of a little firmness by Captain Bickford induced him to say he would consider it. Captain Bickford said he would call again in three hours, and he departed leaving His Highness in some trepidation. Long before the three hours had elapsed, a royal embassy brought us a humble apology from the Sultan to the Governor expressing great regret for what had happened and promises of amendment for the future.

It need hardly be said that the journey to Brunei was replete with interest. It would take long to describe the interesting features of the people and their singular modes of living. My opportunities were but short, but still in that time I was able to obtain some information about the natural history which I hope one day to publish. On our return to the ship we made a special visit to a coal mine at the mouth of the river worked by two enterprising Scotchmen—Messrs. Cowie—on a mining lease granted by the Sultan. There is an immense outcrop of thick seams of tertiary coal, similar in age and appearance to the coal beds at Labuan, at Sarawak and the Dutch settlements on the south coast of Borneo. The mines are very interesting, being worked with the aid of Chinese coolies. Some trouble had been experienced from wandering tribes of Muruts at the time of our visit.

During our stay I also visited the old coal-workings at Labuan. There seems no scarcity of good coal which is going to decay, together with the valuable plant of machinery, pumping gear, tram-stock, loading and unloading pier, &c.

GAYA.—After leaving Brunei the 'Pegasus' sailed for Gaya about 90 miles further north where two Europeans, Messrs. Dalrymple and Little, represented the North Borneo Company, administering the government, collecting taxes, &c. This was one of the most interesting places that I saw in North Borneo. First of all the harbour was of great natural beauty, and not more than about 30 miles from the great Bornean mountain of Kina Balou. This is over 12,000 feet high and is a barren granite peak. The very high summits in the Archipelago are usually volcanic. The harbour is inhabited by Malay fishermen and a few Chinese storekeepers. The North Borneo Company have sago works, which were under the direction of the two European gentlemen already mentioned. The sago is obtained from the pith of the palm tree known as *Sagus laevis*. The material was bought from the natives. We then visited the bungalow which was up a steep hill about 400 feet high and commanding a lovely view. On our way we visited the prison and police station, situated half way up the hill and protected by a battery of four guns, manned by a corporal's guard of the North Borneo police force. In the prison were three head-hunters, wild Muruts, lately condemned for killing a poor Malay. One prisoner had a fearful half-healed gash over his head which his victim had given him. These wild men were of low stature, much fairer skinned than Malays, and of somewhat mild expression. They were quite naked except for a waist-cloth, the skin being slightly tattooed in very pretty coloured patterns.

While at Gaya we made an excursion into the interior among some of the agricultural Dusun tribes. We were six Europeans including three officers of the ship. We were carried across the bay in a small canoe, which was loaded to the water's edge by our large party and rendered very unsafe. Our course was then over some coral reefs between Gaya Island and the sea-shore, being exposed at one part to a considerable surf, which required watchful care to keep the canoe afloat. However, we got across without any other inconvenience than being scorched from the frightful glare and heat of the sun. After skirting along the coast for a few miles we entered the Besagar river, up which we rowed for a short

distance until we came to a small Bajow or sea-gipsy village where we were provided with buffaloes to ride. It rained in heavy showers daily, and the country was quite inundated, with knee-deep water in places, and abounding with venomous snakes of small size, apparently of the genus *Bungarus*. The reptiles appeared to be too much absorbed in the capture of very pretty blue and green frogs, to do more than get out of the way of our buffaloes. We went across some fine rich plains, planted with paddy, all fenced and carefully tilled, as well as anything I have seen in the best parts of China. The beautiful green fields, with patches of jungle backed by the mountains towards which we were journeying, looked wonderfully picturesque. In a few miles we came to another village where we were welcomed by the inhabitants who offered us green cocoa-nuts. Beyond the village the Dusun country commenced. It was neatly tilled and had splendid crops all fenced in in the most orthodox fashion. It would be difficult to describe the extreme picturesqueness of the scenery which was almost European, from the evidences of careful husbandry on every side. The distant villages looked like farm-houses in some rural district. After passing a fine bungalow with an old orange and lemon orchard around it we came in a few miles to another village, which consisted of a house about 150 feet long, and a few other small houses. The style of this building was entirely of that Dyak pattern with which books of travel have rendered us all familiar. We entered it by climbing up a notched log, as it was raised on high piles. On either side was a long enclosed verandah which ran the whole length of the building. Inside the space was divided into dark apartments for each family. In the centre was a long beautifully matted room with a roof some 35 feet high. There we were welcomed by the chief of the village, who in this case was a female. She gave our party a warm welcome, and sent her people to cook rice for us. The central chamber was divided into two, and there were about 60 men, women, and children in each end. The cooking was performed on a small stone fireplace in the middle of the floor, and the smoke went up through the roof. The water and refuse went between the bamboos of the floor.

The Dusuns are not much burthened with clothing. What is wanting in drapery is made up with brass rings, coins, and coils of brass wire round the arms and legs. Nevertheless, they have more clothes than the Dyaks, and they have a modesty and reserve which would become a civilised people. They are not head-hunters except in retaliation, and it is seldom that strings of Murut heads are seen adorning their door-posts. The people bade us welcome, and gave us, after supper, a musical entertainment, in which a furious and unearthly din was performed by the whole strength of the company. After that there were war-dances and sham-fights unpleasantly like realities, making us almost wish to be on board the 'Pegasus' again. There was no word about going to sleep that night. The war-dance terminated about four in the morning, when the ladies gave a vocal performance, which was a very fair rendering of a 50-lb. steam-whistle. This lasted until it was time for us to go back to the boats, which we reached after a most fatiguing journey. This was due to the erratic proceedings of the buffaloes. They had taken an implacable dislike to their European riders, and continually interrupted their journey by senseless chargings at each other, which often unhorsed or unbuffaloeed their burdens into the paddy swamps. I was never in any part of Borneo where finer collections of Dyak and Dusun war and domestic implements can be made. Some of the old Dyak warriors wear a coat of mail which reminds one of the armour worn by the old crusaders. I brought away many interesting specimens of swords, spears, and sumpitan tubes, which were of the finest description.

KUDAT.—From Gaya we proceeded to Kudat on the most northerly end of Borneo in Maruder Bay. Kudat is in the end of the bay where it is fringed by a coral reef. At the time of our visit there were half-a-dozen Europeans at the station which was at one time the head quarters of the North Borneo Company. The government bungalow is a large and more substantial building than usual. Kudat, however, has little or no fresh water. The rock is a carbonaceous sandstone with a steep dip inland. During

our stay at Kudat we went in the government launch to the further side of the bay, on a deer-shooting expedition, which was not successful in the capture of much game but it afforded me a large botanical harvest. On returning at night-time we struck on the outer edge of a coral reef with a falling tide and a rising wind and sea with heavy rain. We remained all night in a most perilous position drenched with water and not without anxiety, as our only boat would not contain three persons. Fortunately we managed to get off the reef at high water next day, and succeeded in reaching Kudat without much difficulty. The population of Kudat reminded me much of that of the Philippines, and it was equally celebrated for cock-fighting.

From Kudat we went to Sandakkan now called Elopura, passing round the northern end of Borneo amid a downpour which exceeded anything I ever saw, in the way of rain. We could not see any distance ahead, and this part of our cruise was especially dangerous, being a perfect maze of coral reefs, which did not show above the water, and upon which there was no break. A narrow strait is formed between Borneo and Banguay and other islands to the north. These groups are mostly inhabited by sea-gipsies of ancient piratical fame. In some places the passage between the reefs is only a hundred yards or so wide. We were sometimes so close to the reefs as to be able to distinguish the coral and the shells, while the shouts between the navigating officer and the quarter-master, and the frequent stopping of the engines, made it exciting work. More than once we were about to anchor until the rain cleared. It was fine in the afternoon, revealing pretty scenery, and Mount Kina Balu showing well up in the south-east.

SANDAKKAN.—Early on the 12th of November we came to the opening of Sandakkan, which is extremely picturesque. On the north side are fine red sandstone cliffs, one 530 and the other over 600 feet high. Inside is the harbour, with a good wharf and many houses crowded round a small hill. At the back of this rise forest-clad hills about 800 feet high. Most of the houses are of native architecture and built on piles, but there were some

striking instances of European influence in the better class of buildings, including some Chinese shops and an hotel. As we passed the sandstone cliffs we saw the base a good deal perforated by caves, into which some natives were entering for edible birds' nests; but much more valuable harvests of the same nests are gathered in enormous limestone caves about 18 miles distant from Sandakkan. In some of this limestone I found fragments of fossil *Fenestella*, *Stenopora*, &c. I take this opportunity of recording the extreme hospitality with which we were received at the North Borneo capital, where every one, from the Governor, Mr. Treacher, to the least official, tried to assist us in every way. I regret to add that many of those who welcomed us then have since perished. During my stay I went across to Bay Island, where I saw a large flotilla of about 50 canoes round a Bajow or sea-gipsy settlement, constructed upon piles far out in the water. I am afraid these Bajows would all be pirates if they dared. So the presence of the North Borneo settlement is of the utmost value to the safety of commerce, which is not the least service it renders to the Indian Archipelago. I visited a coffee estate and tobacco plantation at Suna Lamba, where a good crop of tobacco had been already obtained. I had rather unpleasant experience in returning at night, being overtaken by a violent storm, which exposed us to the wash of a cross sea for about three hours, and I considered myself fortunate to escape being swamped. We had been invited to dinner at Government House, but arrived instead at midnight drenched to the skin.

I saw at Sandakkan specimens of tin, gold, antimony, coal, and corundum. These had been obtained in an exploring expedition made by Mr. D. Daly up the Kinabatangan River. I have no doubt that considerable quantities of alluvial gold will be found eventually in North Borneo.

SULU.

From Sandakkan we proceeded to the Sulu Archipelago, which we reached in two days. On our way we passed the

largest shoal of porpoises I ever saw. They were round the ship quite thickly as far as the eye could reach. We were passing through this shoal for many hours.

Sulu, or Suluk in Malay, is called by the Spaniards Jolo, the "j" being the Spanish guttural. The Sulu Archipelago extends from Cape Unsang, the most easterly point of Borneo, to Zamboanga, the most westerly port of Mindanao, or over 200 miles. The islands are volcanic, over 130 in number, but the majority too small to be inhabited. They are divided into seven groups—Sulu or Sug, which gives its name to the archipelago, Tawi-Tawi, and some others to be mentioned presently.

One peculiarity about the archipelago is that it is surrounded by an enclosed sea-basin of extraordinary depth, while the edge of this basin is a shallow sea of coral reefs. The different portions were visited by me on several occasions, and I had an ample opportunity for the examination of some of the least known portions of the group. It enabled me to conclude that the seabottom has subsided during the period of volcanic activity and this has probably happened in the seas round the most of the Philippine Archipelago. I believe I shall be able to show that the ancient prolongation of the Asiatic continent was extended not only through Borneo, but to some little distance north of the island of Palawan. The proof of this I shall mention in connection with the surveys of H.M.S. 'Flying Fish.'

In Crawford's "Dictionary of the Indian Islands," there is a full description of these islands, which was all that was known about them in 1850. The great incorrectness of this account shows us how little that was. Mr. Crawford's information was mostly derived from Dalrymple.* Respecting its geology, he says we have little or no information, but it will be probably found to consist chiefly of sedimentary rocks, probably limestone and sandstone. This is incorrect as far as the greater number of

*Dalrymple, "Oriental Repertory," 2 vols. 8vo, 1793-1808. The author visited Sulu in 1759 and 1761.

these islands is concerned. They are, as already stated, volcanic. But if the geology is deficient, it is a matter of astonishment that Mr. Crawford was able to obtain so much information about the language and ethnography of the people.

The following is a description of the groups known to the Spaniards. (1) Balanguingui Group:—this group consists of fourteen islands, seven of which are uninhabited. In the rest the population is estimated by the mandarines, as the chiefs are called by the Spaniards, as capable of furnishing 325 men fit to bear arms. This is the peculiar way in which, in this region, information is furnished about the population. (2) Tapul Group:—21 islands, 10 uninhabited, 1,300 men of arms. (3) Group Keknaponsan:—eight islands, nearly all uninhabited, but furnishing 60 men of arms. (4) Group Tawi-Tawi, 42 islands, 30 uninhabited and 1,200 men of arms. (5) Tagbabas Group:—14 islands, none of which are inhabited. (6) Pangutaran Group:—23 islands, 12 of which are uninhabited, and in the rest 440 warriors. (7) Sulu Group:—13 islands, 7 of which are uninhabited: in the others 15,600 warriors, the greater part of whom live in Sulu. The Sulu Group is in every respect the most important of the whole. To this is added the Sulu-Cagayan island, which is widely separated from the rest, and is supposed to have about 400 warriors. This curious way of computing the population is derived from the unfailing war-like and piratical tendencies of the people. The whole number of the inhabitants, men, women, and children, including a large number of slaves is supposed to be about 20,000.

Some of the islands have mountains upon them of tolerable height. Thus Sulu, which is 34 miles long from east to west, has three parallel ranges from one coast to the other in an E.N.E. and W.S.W. direction. The principal summits are Tumantangis about 2,700 feet high, situated on the west, Tulipan on the south-east 1,900 feet high, and Mabustan about 1,300 feet. But the whole of the island is rugged and mountainous, with a width of about 12 miles and a circumference of over 100. It has about 30 towns and villages, the principal of which is Parang on the west

with 3,000 inhabitants ; Maibun on the south with 1,500, which is the residence of the sultan ; and in the centre Siang with 800 inhabitants. The seat of the Spanish government is called by the name of the island and is on the north side. It is a very bad anchorage, the water being so deep that there are only one or two places where large vessels can be secured, and these unpleasantly near the shore.

All the towns in Sulu bear a family likeness to Brunei in Borneo. They are all built on the piratical lines of the Bajows or sea-gipsies, that is nearly wholly over the water on high bamboo stakes. The capital, as we may call Sulu, has a pretty appearance from the water's edge, with the usual Spanish *campanero* and small dome over the church. But Sulu is strictly speaking a military establishment. The military hospital lines the wharf, and the military barracks, with customs' departments of course, form the frontage of buildings, with large convict barracks as well. For it is also a convict establishment. Long-sentenced native prisoners are brought here from all the Philippines, but the poor easy-going Philippine Indian is not, even as a convict, a reprobate. The Spanish government reposes the highest confidence in him. On his arrival at Sulu he is put into uniform, supplied with an old percussion firelock, with a bayonet of soft and easy temper like his own, and thus more than 2,000 convicts co-operate as auxiliaries to the Spanish garrison. Beyond the military and prison establishments there are a few nice streets and squares passably built, and very tastefully adorned with gardens. Here, also, may be found a market, a few shops and some larger Chinese stores where the merchandise of pearls is carried on. Beyond this a strong wall of fortification completely encloses the place. Three miles further is a line of outposts, with towers of observation, for in fact the Spanish foothold is as yet only precarious and the place is held like a beleaguered city.

The history of the struggle between Spain and the Moros or pirates of Sulu dates back over 300 years, and until very lately the Moros had the best of it, and kept to their islands and their predatory habits. If Spain had had a good or strong government,

or had not had its hands almost always full enough of sore troubles at home, it would have settled its accounts with this wasp's nest ages ago. At length, about 12 years back the matter was taken in hand in earnest, and the Spaniards got a foothold. They could not yet afford to despise their enemies however, who, to do them justice, left nothing untried in the way of treachery and savage warfare to make it hot for the Spaniards. At the time of my visit there was a temporary peace. Then came a disputed succession to the throne of the sultan, and a civil war. The Spaniards profited by the occasion nearly to "wipe out" the Sulu nation, and thus confer a lasting benefit on mankind.

During my stay at Sulu I had an interview with the sultan and his court, on the occasion of a visit from one of the rajahs of Palawan. He had come to visit the Spanish governor, and was accorded a public welcome. The peculiar splendour of a Malay court is easy to realise for those who are familiar with the etchings of books of travel in the East, of the last century. Theatrical spectacles and popular illustrations to the "Arabian Nights" will also give an idea of how silks and satins of rose, blue, and emerald green are mingled with tinsel and embroidery, shawls, scarves, and gems, to produce brilliant effects. His Highness of Sulu on this occasion had gorgeous rose satin tights, and was a mass of shawls round the waist, from which more than one jewelled *kris* peeped out. His turban was very brilliant, or, if you like, tawdry, and his whole make-up full of startling contrasts of colour. He of Palawan delighted in yellow satin tights, with other appurtenances which it would require a silk mercer to describe. Both these potentates were surrounded by a body-guard as varied in colours and as rich in materials as their masters, and they carried spears, knives and *kris*es in threatening attitudes that were most objectionable on a peaceful mission, and calculated to distress timid people. Knowing the natural tendency of these pirates for impulsive assassination, I thought their whole bearing was treacherous and it made me feel uncomfortable. When they entered the town they were conducted to the central plaza, where chairs were provided, and we all sat in a

circle while the band played, and played very nicely. It did not add to my enjoyment to find myself close to the sultan, behind whom stood a murderous-looking scoundrel in gorgeous livery, with a loaded revolver resting on his shoulder and his finger on the trigger.

The impressions I retain of Sulu are very scanty. In the market and in the streets cock-fighting is much practised, and a man would as soon be seen without decent clothing as to appear in public without a game-cock under his arm. I remarked the same feature at Kudat in Borneo, but no place comes up to the Philippines in the matter of cock-fighting.

The island of Tataan, the principal of the group of Tawi-Tawi, is almost as large as Sulu. It lies about 30 miles south-east of the peninsula Unsang of Borneo. It rises to a height of about 1,500 feet, and is very rugged. The flora is rich, but the fauna is poor; and though the island is 40 miles long by 30 wide, it is scarcely inhabited.

The whole population are called Moors of Malay race. Those who live on the coast are called Samaluans, and those who live in the interior and are devoted to agriculture are called Guimbals. Between these two there exists a feud which is the cause of much strife and bloodshed.

The language of Sulu is peculiar. It belongs certainly to the Philippine dialects, and is also closely allied to the Malay. Like most of the Mahometan Malays the islanders write in Arabic characters. It may be said that they have two languages, one of which is pure Malay, and the other a dialect of Visayan, or more properly a language of the Philippine family, closely allied to the speech in use on the coast and river banks in Mindanao. It is stated confidently that the Sulu natives are Malays originally from Borneo, belonging to the Moros tribe called also Laununs. But this appears to be a corruption of the word Ilanon, a term at one time applied exclusively to the Malay tribes of the interior of the islands. The skulls that have been compared from Zamboanga and Sulu, have almost equal proportions. The cephalic index varies between 81 and 81.60. The skulls are decidedly brachycephalic, and are distinguished by the constant prominence of the

frontal bone, and for their prognathism which reaches 69. The facial angle does not go beyond 84°, and frequently does not reach that. The cheek bones are not so widely separated as those of the Javanese, and this, combined with the low facial angle, inclines some ethnologists to establish analogies between the Moros and the aborigines of Sumatra. A study of the crania utterly destroys the hypothesis of an Arabian origin, which certain authors have ascribed to this race. The skulls of this people are widely distinguished from the handsome type of the Arab races.

The government of Sulu is an absolute despotism under a sultan, who now no longer refuses to call himself a vassal of the Spanish crown. Subordinate to the sultan the Moors are divided into a great number of tribes governed immediately by chiefs called *datus*. Slavery in its most objectionable form exists among the people. The children of slaves are slaves. Prisoners taken in war, and debtors who are not solvent, are slaves as well. The women are much given to steal each other's children and to sell them in other islands. In many other respects the law which obtains amongst them is the law of the strongest.

Agriculture is not much fostered. Some maize is grown, a little rice, sugar-cane and a number of roots such as sweet potatoes, yams, &c. Cocoa-nuts are abundant, with plantains, *juanis*, which is a mango of strong odour, mangosteens and many other fruits. Buffaloes and dairy cattle are used in tillage and as beasts of burden, but they have a splendid breed of ponies in the island. They have also many goats and Indian sheep. They are great bird-catchers amongst the white cockatoos, pigeons and other birds. But their principal industry, besides piracy and robbery, is the pearl fishery, which is conducted by divers on the edges of coral reefs and on certain beds of the pearl-oyster which abound round Sulu. The people also are clever in making weapons and giving a fine temper to steel weapons. They manufacture their own kris, swords, lances, &c., and they cast their own cannon in bronze.

Most writers have called attention to the singular influence which Sulu has obtained over the other islands. Not only its

influence, but its power and civilisation far exceed that of the other islands, and have enabled the sultan to extend his authority over them and over Palawan, and at one time also over several parts of Borneo and the adjacent islands.

CAGAYANES GROUP.

The Cagayanes Islands, though 130 miles to the north, are included in the Sulu group. I visited these in H.M.S. 'Flying Fish' when we were employed in searching for certain shoals that had been reported in the neighbourhood. The group lies 21 leagues to the westward of Negros Island in the Philippines.

Bounding the west side of the strait are two low woody islands of considerable size. The largest is to the westward, and is filled with islets and rocks. They are surrounded by a reef which projects to the northward. To the south-west, 10 miles distant, are a few small rocks called Cabesa, and at 26 miles a group called Cavili.

Cavili or Caueli is a high sandbank with a belt of trees, the breakers extending nine miles from its south-west side. This makes the islands particularly dangerous, because they are almost invisible from where the reefs begin. The island is wooded with heavy timber, and is surrounded for three-quarters of a mile with a fringing coral reef. The breakers mentioned above are on a detached reef, having on it a small sandbank or cay with trees. In other parts, also, the sand is dry, of an oval shape, the greater length being in a north-east and south-west direction, and in size similar to Cavili. When the Cagayanes Islands bore west by north about 18 miles distant, they were just visible from the deck. The body of them is in lat. $9^{\circ} 34' N.$, long. $121^{\circ} 17' 30'' E.$ There is an opening in the reef off the south point of the most easterly island, with soundings of four or five fathoms inside, forming a kind of harbour for small vessels.

During our stay at Cagayanes we were generally anchored so far from the little harbour just mentioned that it was not easy to make an expedition to the islands. Once or twice we attempted

it in the ship's cutter, but were obliged to return, as the time at our disposal was not sufficient in the state of the weather. All we could do was to land upon some of the sandbanks or cays, where an immense number of boobies had made their nests. Here, also, great flocks of halcyons or frigate-birds were hovering, and waited each evening for the returning boobies with their provender of fishes to feed their young. The plundering of the poor boobies has often been described by various naturalists from the times of Basil Hall to our own day. We used to witness it every night from our anchorage. It is not without amusement that one sees the weaker bird made to disgorge the result of his day's fishing, which, as it falls, the frigate bird catches with a swoop ere it reaches the water. In spite of it all the young birds don't do badly, though they abound in the low stunted brushwood which grows on the cays. The vegetation was of the usual kind found on all coral islands from Australia to Singapore, such as *Terminalia*, *Scaevola*, *Cordia*, *Barringtonia*, &c., &c.

Admiral Belcher of H.M.S. 'Samarang' visited the Cagayanes in 1845. He says, "Effected a landing on a small rocky island in the channel between the two largest islands. A rapid survey was made during our detention of six hours. Found three more islands and very extensive reefs extending as far as the eye could reach, from our most elevated situation about 100 feet above the level of the sea. The islets are upon the outlines of the northern reefs, the most distant about 10 miles. Visited by a boat from the pueblo, which was pretty large and contained a whitewashed fort and church. We had not time to examine it; but one of the authorities deputed to make inquiries about us, and who endeavoured to make himself understood in a jargon of Spanish, Malay and Visayan, assured me that everything I inquired for (bullocks, vegetables and fowls) could be procured at the pueblo. From the tenor of their inquiries, I was led to infer that whale-ships touched here for water and refreshments. The bays and creeks in the interior of the extensive sound formed by the two greater islands are very picturesque, and have at their entrance or chord of the bay a depth of not less than $3\frac{1}{2}$ fathoms."

COCHIN CHINA.

I visited the port of Saigon in the course of my travels, on my way from Hong Kong to the Malay kingdom of Pahang. It takes but three days to go from Singapore to Saigon, passing by Pulo-Condor, the Malay name for the island of reptiles, which is inhabited by a population of about 300 islanders. The entrance to Saigon is by the Cocoa-nut Bay and then up one of the many branches of the river Me-Kong, which flows through the delta of Cochin China. The time of my visit was unfortunate, for the Tonquinese war was going on, and cholera was causing great ravages amongst the people. The establishment of the French Messageries is at an angle of the river just at the entrance of the town of Saigon. All along the sides of the river crowds of sampans and canoes remind one of Hong Kong, though not nearly so numerous. There is a certain floating population here as in all China. There are families living continually on the water, eating, cooking and sleeping in a space incredibly small, while the infants are cradled in a swinging cot like an aerial plant, with no trouble in rocking. At night there is the usual sparkling of light and tinkling of sounds from the flotilla with its living freight.

There is nothing to be seen in coming up the river, except the low banks at either side, until one comes in sight of Saigon. This is only indicated by the two tall square towers of the cathedral and a forest of masts and steam-funnels above the wide brown dead level plains. We did not pass many boats except a few fishermen in vessels rigged like the feluccas of the Mediterranean. A few low attap or palm-leaf houses may have been indications of villages. The people looked like Malays, and, except that they are slighter in stature and have smaller features, reminded me very much of the Javanese. They are not like Chinese, and they do not wear the queue. The women wear long loose dresses of blue or white material, and over this a long dark blue robe like a soutanne. This, with a large silver ring round the neck and a good many pins in the hair, completes the costume. There is little difference between the male and female costumes, except that the men commonly wear something on their heads with combs of

tortoise-shell and silver. The general aspect of the people is prepossessing, with a more amiable manner than the Chinese, combined with much modesty and decorum.

SAIGON.—The wharf at the Messageries is prettily shrouded at its termination with clusters of mango, tamarind and cassia trees. There is about half-a-mile of road from this through swampy plains into the town, but one can enter it in a shorter way by crossing the elbow of the river in a boat. The town itself is thoroughly French, and, but for the motley suits of the inhabitants and the luxuriant trees which fringe the pathways, one could well imagine oneself on the outskirts of Marseilles, or some French town on the Mediterranean. The streets are wide and regular, with unceasing groves of tamarind trees. The cafés are numerous, with a homely array of benches and tables extending into the streets, round which there are always crowds of soldiers and officers gathered. Whatever business is done is almost confined to the Chinese, who have most of the large shops and stores in their hands. Apart from the military, there cannot be much European population, but there are a few shops or *magasins* of the usual French type. However, a walk through the town of Saigon does not take very long, and whatever there is to be seen is soon disposed of.

About two miles out of town are the Botanic Gardens, which, though only in their beginning, are as good as anything that can be seen in the East; but one cannot walk far without coming upon some of the unreclaimed portions, and this for the present mars the effect. The zoological collection is very good, with two of the largest tigers I have seen anywhere. In a country where the plumage of the birds is in perfect harmony with the luxuriant foliage and the flowers, a large aviary well kept and tastefully arranged is a beautiful sight worthy of the famed splendour of the East.

At a short distance from the gardens, in a rather dreary-looking plain and surrounded by large military barracks, is the cathedral. It is a stately and imposing-looking building, even though it is stuccoed and coloured with yellow limewash. One cannot help

being struck with the facts that this cathedral represents. The stately pile dedicated to St. Francis Xavier, the patron of missions, stands on a spot where a few years ago the brave missionary had to hide amongst a few fishermen's huts, and baptized his converts at the imminent peril of his life and theirs. There have not been wanting in Saigon many illustrious apostles, who laid down their lives in testimony of the truths they preached. And now the seed has produced its fruit, and the religion of the martyrs is the dominant one at Saigon. Unhappily there has been a conquest by the French flag as well as by the cross. The case may have been one where the force of circumstances produces events which no one could control; still all friends of the true interests of Christianity must wish that the territorial conquest and the work of the missionary had been kept entirely apart.

With cholera and small-pox all around, and the city full of sick patients invalided from the seat of war, and with the war itself going on, not without disaster to the French arms, it may be guessed that Saigon was not the most agreeable sojourn for a tourist.

There are a number of little villages in the plains outside Saigon. The native houses are much in the Malay style, with the usual shelter of tropical fruit trees and a formidable hedge of bristling cactus. During the dry season there are some pretty promenades amongst the Anamite villages. A much-frequented excursion is to the tomb of the Bishop d'Adran. Besides this the principal journeys for tourists are to the town of Cholen, "Les Jardins des Mares," the stand, the rifle butts, &c.

Two roads lead to the tomb of the Bishop d'Adran: that of the third bridge is the most picturesque, passing before the government offices, the native camp, and the place where formerly the literary examinations used to be held. It was there that, on the 5th of April, 1862, the treaty of peace between France, Spain, and Anam was signed. At present it is a barrack for the marines. Leaving to the right the rich village of Go-vap, one meets a succession of farms for the cultivation of tobacco,

pea-nuts, and the fruits and vegetables which supply Saigon. Amidst these there are remarkable tombs under handsome groves of mango trees and sugar palms. The track is hardly practicable except on horseback, but by the village of Thuan-keou vehicles go right up to the tomb.

On leaving Saigon one sees the pagoda of Barbet, so called after a captain of marines who here fell into an Anamite ambuscade and lost his life. Here also King Minh-mang was born in 1789, and in memory of this event his father, King Gial-Ong, raised this pagoda, giving it an Anamite name, which signifies "The Aurora of Promise." At present the pagoda and its dependencies are used as a colonial state school.

This road crosses the Plain of Tombs, an immense cemetery, which proves that Saigon has long possessed a considerable population. The appearance of these tombs is very peculiar. They are occasionally little pyramids with a square or hexagonal base, or small pagodas in miniature, with doors "arch in arch," and guarded by stone dragons. More commonly they are square graves scattered without order on an arid, dusty plain, which boasts only of an occasional clump of trees. This is the aspect of the country which extends from Saigon to the Chinese town of Cholen and the lines of the Ki-hoa.

After having crossed the moat one sees the traces of defences constructed by the Anamites at this point, for it was here that the most desperate struggle took place of all the battles of the war of Cochin China. It resulted in the taking of the works by Admiral Charner in 1861. Here Col. Testard and Lieut. Larégnère were killed. A monument in marble has been raised to the memory of the latter officer at the place where he fell. Close by is a grand grove of mango trees, and it is here that the Bishop d'Adran dwelt, and he it was who introduced mangoes into the country. The name of this prelate was Monseigneur Pigneau de Behaine. He was born at the town of Aurigny, near Laon, and was Vicar Apostolic. It was through his efforts that a treaty was concluded in 1787 between Louis XVI. and King Gial-Ong. This treaty would have been of the greatest use to France if the

ill-will of the French governor of Pondicherry and the confusion of the revolution of 1789 had not interfered with its good effects. The French say the Bishop d'Adran rendered the greatest services to King Gial-Ong, or Nguyen-Anh, for he had both names. The benefits derived from these services have proved somewhat equivocal, for they have led to the annexation of the country. However, they subdued the king's enemies for the time being; and as soon as he was peacefully established on his throne, Bishop d'Adran retired to the garden that he possessed near Saigon. He died 9th October, 1799, and the king gave him a magnificent funeral. He raised over his remains a monument in the style of an Anamite pagoda. Within this is an altar on which one sees the double blazon of the episcopal see and the arms of Monseigneur d'Adran, on whom the king of France had conferred the title of Count. Opposite the tomb is a stone covered with Chinese inscriptions. The whole is surrounded with an encircling wall, ornamented with the conventional animals such as the Cochin Chinese delight to put around their graves. This tomb has always been respected even when the Anamite troops occupied the plain of Ki-Hoa.

CHOLEN.—Every one who visits Saigon goes to see Cholen, which is five or six kilometres distant. Boats go every half-hour, and the passage is a most picturesque one. There is also a railway of modest pretensions, which passes along the roadside, leaving to the left the pretty village of Choquan, and in five kilometres one arrives at Cholen. The entrance is in front of the public offices of the paymaster, the prefecture, the telegraph office, barracks for the French garrison, and many pagodas, amongst which is the pagoda of the warrior gods. On the principal altar is an idol with a white beard having in his hands a bow and arrows. This is probably Kouang-Ti, the Chinese Mars; his son Kouang-Ping and his faithful esquire are at his sides. There is also the temple of Kwan-Chin Whay-Quan, erected by the Chinese of Canton to the goddess Koang-Yn or Apho, the creative power, the mother of the Chinese of Canton, the patroness of navigators and the Chinese Amphitrite.

The town of Cholen has a population of 10,500 Chinese, 32,000 Anamites, besides a floating population of 8,000, which gives a total of about 50,000 souls. It may be here mentioned that though Cholen is the head-quarters of the Chinese, they are pretty well scattered also throughout Cambodia. The first extensive arrival of Chinese took place about 1680, in the west of Cochin China, and was from Canton. A part was established at Bien-hoa, and a part at Mitho. This immigration was followed by many others coming from Fokien and other Chinese provinces. The superiority of their civilization and their wonderful aptitude and talents for trade, their spirit of association, their community of religion and customs, and of writing with the Anamites gave to the Chinese a great footing in the country. After the war between the rebels of Tay-Son and King Gial-Ong, they quitted their first establishments and came to dwell in Cholen about 1778. Although in 1721 the chief of the Tay-Son rebels had massacred more than 10,000 Chinese, and pillaged their stores, yet they continued to progress. Notwithstanding nine months of frightful famine in 1802, notwithstanding the prohibition to export any produce from the country, the perseverance of the Chinese surmounted every obstacle, and in 1830 Cholen was already a market of great importance, which the Chinese had named Taingon, and the Anamites Sai-gon. The only name now in use for the town is Cholen, Cho meaning market and lon, great. The Chinese are principally aggregated together in hongs or corporations. The chiefs of these congregations are responsible for their members as in Java.

The Chinese generally marry Anamite women. They have very pretty children, and the mixed race forms a very intelligent class amongst the natives, which is named Minh-huong. These half-castes are generally well off.

The town is divided into five quarters, each having a Chinese chief, a Minh-huong chief, and an Anamite chief. It is found to be very necessary to oblige the Anamites to take part in public institutions, as they are by nature indolent and retiring, or apathetic to a pernicious extent. The town has quite a European

aspect: the streets are large; there is a canal with wide quays on each side. Amidst these quays are crocodile parks where these saurians are preserved and fattened for eating. The houses and shops are well built, and the whole place has an astonishing air of industry and prosperity, which reminded me of Penang or some of the best Chinese towns in Java.

About a quarter of an hour's walk from Cholen, on the road to Mitho, is the garden of Cay-mai. In a delicious situation on an artificial mound the Cay-mai tree grows, whose sweet-smelling flowers were offered to the Emperor to flavour his tea. It was death to touch them in former times. From this point the view extends over the ricefields which line the commercial canal, over the Plain of Tombs, the mines of Ki-hoa, the fields and the woods of Go-Vap as far as the mountain of Tai-Minh, a distance of nearly 100 miles.

It must be understood that it is only the lower part of the delta of the Me-kong that is called Cochin China. The upper portion of the river to the north-west is occupied by the kingdom of Cambodia. To the north-east is the kingdom of Anam. The boundaries of French Cochin China are between 10° and 11° N. lat.

One sees but few Cambodians at Saigon. They are easily recognised by their short hair, their shovel hats, and their dress. They are more robust and taller than the Anamites. They wear a loose robe with a little vest buttoned in front and a cincture of silk. Often they have only a piece of calico over the shoulders. Some come by boats from higher Cambodia to bring their produce to Cholen. Others come from the lower Anamite provinces, and others from the right bank of the great river by the route of Trambang, and bring herds of cattle and sheep.

The French have established schools in Saigon and Cholen, which are eagerly made use of by the Chinese and Minh-huongs. The Anamite character is the Chinese a little modified. It is at once ideographic and phonetic, so that they have no difficulty in writing European words. A Chinese not knowing the Anamite language can make himself understood by the characters which,

though quite different to him in sound and pronunciation, represent the same ideas in the two countries. All official documents are written in Chinese.

There are two native newspapers, the Gia-dinh-bao, a gazette printed in European characters, and another journal, Nhut-Khim-Nam-Ky, which means the journal of Cochin China. The Anamite language is intoned, and it has six tones, like the Chinese; the same word having, according to the tone, many significations. It is extremely difficult to Europeans. The whole time at school is taken up by the natives in learning the characters. It takes years to be able to read a book. The best books to consult for this study are the Latin-Anamite dictionary of Mgr. Taberd, of which M. Aubaret has edited a French-Anamite edition; the dictionary of Père Le Grand de la Liraye; the grammar of Père Fontaine, and the vocabulary of Peter Ky. Like the *Pigeon-English* of Hong Kong, Cochin China boasts of a Pigeon called Sabier, a word of Portuguese origin. It is a mixture of Chinese, Portuguese, English, French, Spanish, Latin and Anamite. A specimen will suffice. Look, sir. Tou tou or, choum-choum, and so forth.

I conclude this short notice of Cochin China by saying that the people seem contented and happy, and the country progressing. The only persons who seemed wofully out of sorts were the French themselves. One soon becomes convinced that this colony has become painfully oppressive to the French nation. First of all, Cochin China is far from France; the climate is difficult to bear for any length of time; the French do not want to emigrate; the land is in the hands of natives, who are cultivators; the industrial uses of products are in the hands of Chinese, who have all the capital. The poor Frenchman shrugs his shoulders and says that this is not a country to organise or to colonise. The mission of civilisation has hitherto unfortunately demanded much gunpowder and bayonet; and, besides the military, the colony only gives support to about 400 unhappy French people, who one and all continually bewail their exile.

While in Cochin China I found the work of Chas. Lemire, entitled "*Cochin Chine Française*" (Paris, Challamel, 1884), a most useful guide, and it is to its pages many of the foregoing statements are due.

HONG KONG.

I first visited the south Chinese coast in 1885, arriving at Hong Kong in the middle of January, or, as I may call it, the depth of winter. It was piercingly cold at the time. All the inhabitants who could afford them were wrapped up in winter furs. The air was cloudy, damp, gloomy and raw to an extent which recalled to my mind the melancholy fogs of London. Having come straight from the fervid temperature of Singapore, the change can be imagined. Three days after leaving the Straits all our Chinese passengers came on deck swathed to the eyes in quilted silks or cottons. It was evident that we were in a new region. We were passing many fishing junks of the unmistakable Chinese pattern: the sails of palm canvas, with bamboo laths across them like Venetian blinds. These junks, with thin radiating ribbed sails, apparently lop-sided and conspicuously down by the head, are characteristic sights to be seen nowhere but in China. In their marine architecture, as in everything else, the Chinese keep distinct from all the world.

Amid the fog and mist which came thickly down upon us, we steamed amongst many barren-looking granite islands, about the fifth day from Singapore. At last one island with a very high peak upon it, loomed out from the clouds at no great distance, soon near enough to discern the forests of masts and crowds of steam-funnels, junks, sampans, and small steam launches which told unmistakably of a large seaport. As we neared it in the dull light of that cold foggy day, it looked as picturesque as any place I have ever seen. It may be defined as thick rows of masts; then handsome terraces of houses rising tier above tier upon such a steep incline that they looked as if each higher range were founded on the chimney-pots of the other. About half-way up the houses

ceased, and then diagonal and zig-zag roadways, with scattered villas rapidly ascended into the clouds. A piercing cold Siberian wind was blowing keenly upon the animated scene of great rafts of steamers loading and unloading, a goodly fleet of men-of-war, and, as we neared the wharf, excited, surging, shouting crowds at the water-side. Hong Kong has often been described, but its wonderful population must be seen to be understood. Enormous crowds of boat-women, junk sailors, and coolies, which make a living stream on the quay, have no parallel in Europe or Asia.

Certainly Hong Kong is not a Chinese town, but a town for Chinese, but yet not of European architecture, nor like the Straits Settlements. Its crowded by-streets and lanes, the absence of horse-carriages, the presence of chairs and jinrickshas make it very peculiar. There are plenty of soldiers in red coats and plenty of sailors in naval uniform, and all sorts of picturesque Chinese costumes, a few Hindoos and Malays, besides Parsees of portly presence and European dress surmounted with a hat like a stove-pipe.

I am not going to describe any more of Hong Kong. I believe it is the most hospitable town in the East, almost surpassing the Straits Settlements and Shanghai. The merchant princes live in real splendour, extravagant if you will, but really comfortable. In winter sporting, hunting and other such amusements are out of the question; but for cricket, lawn-tennis, foot-ball and such like, and for balls, parties, private theatricals, &c., it is the gayest of gay cities. Yet I am told that the officers of the army and navy do not care much about being quartered at Hong Kong. Even gaiety becomes monotonous on an island scarcely nine miles long, so rocky that you cannot ride, and where pirates and squalls keep people from boating or fishing.

The island formerly constituted a part of the district Sun-on. It is scarcely a mile from Kiu Lung or Kow Loon on the main land, which is also British property. It is mainly granitic, but with a varied geology, so as to make it a most interesting place of study. There are some volcanic dykes in places, and traces of minerals, especially lead and molybdenum, of which fine

specimens may easily be obtained. The highest peak is 1,825 feet high, and there are other peaks ranging between that height and 1,000 feet. Hong Kong as far back as the Ming dynasty belonged to the Tang family, whom I suppose everybody knows. It is an island at the mouth of the Canton river, and was a noted resort for pirates, who used to lie in wait for sailing craft in the Ly-ee-mun pass, a very narrow strait between the mainland and the island. In January, 1841, it was ceded to Great Britain. The capital is called Victoria.

VEGETATION.—It is an exceedingly picturesque island with a coast indented by several deep inlets, with bold headlands, broad sandy beaches and precipitous cliffs, giving rise to beautiful varieties of scenery. The surface soil is poor and stony, and for the most part with a poor heath-like flora, barren and bleak in the extreme. The more sheltered valleys and ravines sustain trees of stunted growth, consisting of few species such as *Pinus sinensis*, *Ternstroemia japonica*, eight small species of oaks and some others.

The greatest interest was attached to the knowledge of the Hong Kong flora; it was, so to speak, our first insight into the botany of China. Small contributions to its knowledge were made by Messrs. Hines, Champion, Hooker, Hance, Harland, Wright, Eyre, Wilford, &c., but the complete enumeration of the flora was not made until G. Bentham published his list in 1861. This included 1,056 species, distributed into 591 genera and 125 orders. More than ten years afterwards, a supplement was published by Dr. H. F. Hance, who added 73 new species and distinguished a few more which had been included by Bentham in other genera or species. This very large total amount found upon so small an island is wonderfully interesting. Another noticeable feature in this large census is the tropical character of the great majority of species, though the general aspect presents features of much more northerly latitudes. Though the more sheltered valleys and ravines on the northern and western sides are saturated with moisture during the long-continued rains of spring and summer, yet the temperature and degree of humidity are very variable.

As the island is exposed also to the burning heats of a tropical sun, and frequently the cold devastating fury of a Chinese typhoon the average range of the thermometer is between 45° and 100° of temperature, but greater extremes of cold are occasionally felt. Another peculiarity of the flora is the large proportion of arborescent and shrubby species on a rocky mass, where woods are limited to a few ravines or short, narrow, half-cultivated valleys. Other exceptional features may be enumerated as follows. First, there is a very great diversity amongst the species themselves. Secondly, as a consequence of the former feature there is a notably excessive proportion of orders and genera to species. Thirdly, there is a considerable number of monotypic genera which, according to Mr. Bentham, is far larger than that of any other flora known to him. Lastly, there is a very large number of endemic species not known to exist outside the island, though probably their range will be found to be greater when the flora of China is better known.

Out of the thousand and odd species belonging to the flora, it must be said that 100 of them are weeds which follow cultivation, or plants cultivated in spite of man. The greater part of these are indigenous to tropical Asia, with a dozen European strangers, and half that number from America.

The Hong Kong flora has little resemblance to the American, but there is a strip of American plants found in Japan, and gradually falling away through Manchooria in Central Asia, though a few are found as far as the Himalayas. This flora passes to the north of Hong Kong, though it has a few representatives such as *Lespedeza*, *Solidago*, *Eupatorium*, *Olea marginata*, *Gelsemium*, &c., the other American plants found in Hong Kong are such as are diffused through tropical Asia generally. One stranger (*Teucrium inflatum*, Sw.) makes its way to the island through the South Pacific Islands.

With Australia the flora of Hong Kong has a small connection, but mostly in insignificant herbs, maritime plants, grasses, and sedges, some of which are of wide range; while others, such as *Styloidium*, *Mitrasacme*, *Thysanotus*, *Philydrum*, are characteristically Australian.

The general character of the Hong Kong flora is that of tropical Asia, but many of the species attain their northern limit in the island. The flora of the damp wooded ravines contains some species of north-east India, such as *Kahsia*, *Assam*, and *Sikkim*. Others have a much more tropical character, extending with little variation over the Indian Archipelago, the Malay Peninsula, and even to Ceylon and tropical Africa. Northwards of Hong Kong the tropical character of the vegetation changes rapidly. This is seen in a remarkable manner in the relations of the flora to that of Japan. A number of Japanese species range across to the Himalayas. But they come no further south than Amoy. This port is only two degrees north of Hong Kong, yet there the tropical character of the flora has entirely disappeared. There are, however, some characteristic Japanese plants to be found in Hong Kong, such as *Kadsura* (*Magnoliaceæ*), *Stauntonia*, *Actinidia*, *Camellia*, *Eriobotrya*, *Distylium*, *Benthamia* (not extending further south or west), *Farfugium* (cultivated in Loo Choo and Japan), and *Houttuynia*.

About 159 species are supposed to be endemic, but one reason for this is the wholesale destruction of every kind of plant which goes on upon the mainland. The people being destitute of fuel burn everything, even to the roots of the grasses. This gives a tanned and barren appearance to the land in most places, which is very desolate, and, united to the dilapidated and sordid aspect of all Chinese houses, makes the scenery in South China dreary in the extreme.

The orders most numerous in Hong Kong are as follows:—*Gramineæ*, 86 species; *Filices*, 75; *Leguminosæ*, 72; *Compositæ*, 67; *Cyperaceæ*, 62; *Euphorbiaceæ*, 52; *Rubiaceæ*, 42; *Orchideæ*, 36; *Urticaceæ*, 27; *Scrophularinææ*, 21; *Acanthaceæ*, 18; *Verbenaceæ*, 17; *Labiataæ*, 16; *Myrsinaceæ*, 15; *Laurinææ*, 14; *Apocynaceæ*, 13; *Convolvulaceæ*, 13; *Ternstroemiaceæ*, 12; *Malvaceæ*, 12; *Rosaceæ*, 11; *Asclepiadeæ*, 11; *Solanaceæ*, 10; *Polygonaceæ*, 10; *Amentaceæ*, 10.

The above will give a good idea of the general character of the flora.

The genera most numerous in species are, exclusive of the cryptogams, as follows:—*Panicum*, 16; *Ficus*, 15; *Imbristylis*, 13; *Cyperus*, 12; *Quercus*, 10; *Polygonum*, 9; *Carex*, 9; *Eragrostis*, 9; *Desmodium*, 8; *Phyllanthus*, 8. Five genera have seven species each, 10 have six, seven have five, 14 have four, 43 have three, 91 have two, and no less than 408 genera have but one species each. This large disproportion of the small genera is one that frequently meets us in floras which are on the borders of several botanical provinces. The cryptogamic flora is not so well known. Like all moist climates the ferns are numerous and beautiful, including 13 species of *Aspidium* and 10 of *Asplenium*. The ornamental drooping fronds, on every wall and terrace, of *Pteris cretica*, *P. longifolia*, *Gleichenia dichotoma*, *Adiantum lunulatum*, and *A. cordatum*, make the moss-grown walls of Hong Kong a mass of the prettiest vegetation. The indigenous and introduced ferns of the island have been made the greatest use of for ornamental purposes in the lovely shady walks in and about the city and suburbs of Victoria.

The moss flora of Hong Kong does not appear, according to Dr. Hance, to be at all rich. He gives a list of 20 species recognised up to 1872.

Some of the remarkable features of the flora of Hong Kong may be summed up as follows:—*Rhodoleia championi* is a beautiful small tree found only in the island, resembling camellia, while the bright pink petals of the five or six flowers of the head are arranged camellia-like. *Camellia hongkongensis* is another floral beauty of the island. The hillsides are likewise covered with bushes of *Rhodomyrtus tomentosa* with large pink flowers. *Enkyanthus quinqueflorus* is an elegant shrub with showy red flowers tipped with white. Probably this is the only species known of the genus. *Melastoma repens*, *M. macrocarpon*, and *M. decemfidum* are three very pretty members of the genus, which cover the hillside with pink flowers nearly all the year round. *Ipomoea tuberculata* is also spread more or less over the island, flowering during the whole year. Dr. Hance says no plant grows

so rapidly and spreads over such an enormous space, while it twines so as to kill many trees and shrubs. The old stems are so tenacious as to make admirable ropes. The arborescent flora, besides the oaks and fig-trees already enumerated, includes a beautiful chestnut tree, the white-stemmed *Liquidambar*, *Altingia chinensis*, and *Styrax odoratissima*, with most fragrant racemes of flowers like white lilac. Hong Kong can boast, amongst its trees, of two maples and a small tree of great beauty when in flower (*Pentaphylax euryoides*), having crowded white blossoms like *Eurya japonica*, which is also found here. The island has also several species of *Euonymus*, a very handsome *Aquilaria* having its flowers in short terminal racemes. *Scolopia chinensis*, a tree allied to that which produces arnatto, is very common in the island; as well as *Schoepfia chinensis*, with axillary racemes of sweet-scented pink flowers.

The coast flora of the island is of the usual tropical marine kind, such as is found on all the islands of the Indian Archipelago right down to Australia. This means mangroves, *Hibiscus tiliaceus*, *Scævola kœnigii*, *Guilandina bonducella*, *Acanthus ilicifolius*, *Morinda*, *Randia*, *Vitex*, &c.

FAUNA.—The fauna of Hong Kong includes but a few bats, rodents, birds, and reptiles. A monkey has been seen upon one of the neighbouring islands, and probably, when the population was less, used to visit Hong Kong. It is a short-tailed macacus (*M. St. Johannis*, Swinhoe). I take the following summary from the writings of Mr. Swinhoe in the 'Zoological Proceedings' and the 'Ibis' on the Zoology of China, and the summary of observations on the same subject contained in Dr. Denny's work on the Treaty Ports:—

There is a fair number of species of Chiroptera or bats, a flying fox, *Cynonycteris amplexicaudata*, Geoff., a house-bat, *Vesperugo abramus*, Temm. Also, *V. molossus*, Temm.; *Scotophilus heathii*, Horsf.; *S. temminckii*, Horsf.; and *S. pumiloides*, Tom., and several others. The musk-rat (*Sorex murinus*, L.), scatters its oppressive perfume as plentifully about the basements of buildings

as it does throughout the whole of the East. I have more than once had unpleasant experience of the fact that these animals passing over bottles even with metal capsules, will impart a musky flavour to the contents. A badger (*Meles chinensis*, Gray), common enough in China, has been found in the island, as well as the pale red Chinese fox (*Vulpes hoole*). The Siberian red stoat (*Putorius sibericus*), is a great enemy of the henwife in some villages. A civet (*Viverra zibetha*, Linn.), and a squirrel (*Sciurus castanoevris*, Gray), both widely-spread species, occur on the island, besides rats and mice. The wild boar (*Sus leucomystax*, Temm. and Schl.), affords occasional sport as it does throughout Japan and Central China. There is some talk about a deer (*Cervulus reevesii*, Ogil.).

GEOLOGY.—The island of Hong Kong mainly consists of granite; but there are places where the mica is replaced by hornblende and various changes are undergone by the micas and felspars. In fact it is a most varied rock, besides being penetrated by porphyritic dykes, as well as some of very recent basaltic trap. Excellent instances of the latter can be seen at Quarry Bay. The granite is also somewhat rich in molybdenum. On the shores all round the island excellent sections can be seen, especially from West Point to the north of Stanley, where there are outcrops of granites and metamorphic rocks. At Pok-fa-lum, at the reservoir, the granite assumes a porphyritic character, of dark colour. A similar outcrop is noticed at Deep Bay. Limestone is found in small quantities with large deposits of kaolin, derived from the disintegration of granite rocks. The geology of the island has, however, been well studied, and needs no further notice here.

This concludes my observations on the first part of my travels. In a subsequent portion I shall deal with the Philippine Islands, and some other parts of the south Chinese coast with its dependent islands.

NOTES ON THE NATIVES OF WEST KIMBERLEY, N.W. AUSTRALIA.

BY WALTER W. FROGGATT.

The natives of the portion of North West Australia known as West Kimberley, though differing little in habits, may be divided in two groups, namely, the coast tribes and the inland natives. The former are characterised by prominent foreheads, round faces and often a pleasant cast of countenance ; the latter have retreating foreheads, some of the old men being most villianous-looking fellows, and though much more warlike they are smaller and not such well-built men as those of the coast.

Living among the rugged limestone ranges that intersect this country, the inland natives do not use shields or boomerangs, but trust to their stone-headed spears, or to the opportunity of throwing rocks down upon anyone following them into their native fastnesses. They are, I am credibly informed, cannibals, eating any of their own dead that are killed in battle ; but I have never had personal proof of this fact. They build no mi-mis as they obtain ample shelter in the numerous limestone caves.

Their food is principally mussels (*Unio*) which abound in the lagoons and river-beds, the nuts of the baobab tree (*Adansonia*) and the roots of an Arum which grows on the moist flats ; this diet is sometimes varied by snakes, kangaroos, or a crocodile, the capture of one of the last-named being a great event, for as long as the gins can get anything to eat the men lie about too lazy to hunt. The men wear nothing but a band of twine, made from

the inner bark of the baobab tree, round the waist, and a similar one round the forehead; their long hair is tied up in a bunch at the back of the head, in which they carry all their spare spear-heads, on which they set great value. The young piccaninnies often have a band of human hair round the waist; the gins have a small fringe of soft woolly string, and the boys a similar one only shaped like a big tassel, made from opossum fur worked into string by rubbing between the hands, and twisted on a primitive spinning-jenny, which is held between the toes.

At the age of nine or ten the boys are circumcised, for which purpose they are taken away from the camp on a fixed day by the old men. This rite is performed at day-break, after chanting and singing all night; and men are stationed round whirling flat oval sticks, on which are carved curious symbols; these sticks flying through the air make a loud whirring sound warning the gins and children away from the place. No gins or uncircumcised boys are allowed to see the sticks, which at other times are kept carefully wrapped up in bark. About five years later, the young men undergo a much more severe rite, namely the splitting of the urethra, which is conducted with further mysteries in a secluded place. The only reason that I could learn for this curious mutilation is a statement of an old man, that until it was done "they were all the same dog (or other animal)".

The gins are held to be of little account, so that after death, except in the case of a favourite wife, their bodies are left unburied where they die. The corpses of the old men and children, however, are swathed in paper-bark and placed in clefts in the rocks out of reach of the wild dogs. In some caves Mr. Gunn and I explored in the Oscar range, we found scores of these remains, many of the skeletons quite perfect until we handled them when they fell to pieces. If a child dies when away from its people, the natives with whom it may be, have to bring the

remains back with them as a proof of its death. Often, as a punishment, the women are compelled to carry the dead bodies of their children about with them for months before depositing them in the rocks. After the second operation above referred to, the young men have each a boy to wait on them, and, if fortunate, they may get some old man's cast-off old hag, discarded for a younger wife. It is only the old men who have more than one gin. This, among the coast tribes, leads to a great many quarrels, for the young bachelors are always trying to steal gins, and have a regularly fixed plan. Creeping up beside the sleeping man they try to transfix him with a hunting spear, and then, seizing the coveted gin, they travel through the bush to the next tribe. If the husband is not killed, as soon as he has recovered, he starts in pursuit, and a meeting is arranged which is quite a formal duel. If the aggressor comes off best man, he keeps possession of the woman ; but if the husband is victor, the vanquished man stands up before him while he takes a sharp hunting spear, and drives it through the fleshy part of the offender's thigh, and draws it out again, after which they are friends, but the young man must never again meddle with the family affairs of the elder. All the female children at birth are promised as wives to male friends of the family ; and I have often seen an old man nursing his future wife. There is a curious custom among them known as *rambour* ; when a young man is promised as wife the first female child that a certain young gin may bear, though at the time she may be quite a girl and unmarried, he is then said to be *rambour* with this gin ; and accordingly they must not speak or even look at each other, and if he comes into the camp, she slips away and hides in the bush till he goes away.

Tattooing is extensively practised among them, many of the old men and gins being covered with great wheals of flesh from this cause ; and I believe that many of these marks are made in memory of some special event or exploit, as among the women on

the birth of the first child. The gins have two of the front teeth of the upper jaw knocked out.

Though they seem to have no idea of God, they have arrived at that state of advancement to believe in a devil, *Nourie*, who lives in the deep limestone caves, and wanders round their camps at night, sometimes catching an unfortunate native, whom he is said to carry off to his home and eat. When they hear him coming they crouch round the fire ; but, strange to say, there is often one of the party who can drive him away, being spirit-proof, and even sometimes kills *Nourie*. "Did you ever see a dead *Nourie*?" I asked a blackfellow. "No, the darkness carry him away," he poetically explained. He also told me one day that the fruit of a creeper only found growing under the rocks was *Nourie's* food.

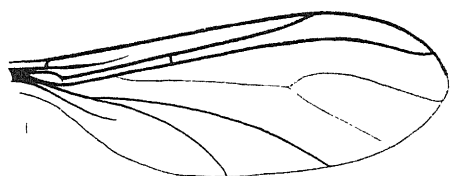
Is not this man who can kill or drive devils away the first idea of a priest? They can understand a man being killed, but are certain, if one dies from natural causes, that somebody must have caused his death, believing in witchcraft to the extent that many of the old men imagine they can kill an offending enemy in the following manner :—A flat stick, pointed at both ends, is carefully carved, and often marked with certain symbolical lines (mysterious curses, no doubt) ; then, when the offender is asleep, the operator crawls up and passes it over his face and round his limbs ; and it is said that sometimes when a man hears that this has been done to him he wastes away with fright. This has led to a curious custom among the coast tribes, though I could not hear that it is ever done inland. When a man dies his body is fixed in the fork of a tree, with all his weapons beside him, and in the ground under the body a number of small sticks are stuck, some pointing *callancar*, north ; some *bana*, south ; some *dirvan*, east ; and others *yaban*, west. Returning in a few days' time his friends carefully examine these sticks ; if none of the matter

from the putrid body has fallen on them, it is all right ; but if one is soiled, then it is in the direction to which that stick points that the murderer lives, and they then and there decide upon the best means of killing him.

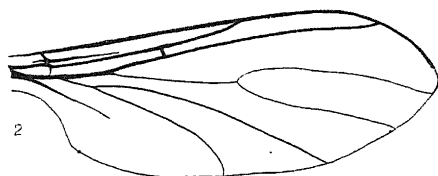
The coast tribes do not build huts, but make mosquito-pits to defend themselves from these terrible pests, which swarm over the low-lying coast country. Digging a circular hole in the sand about two feet deep, they roof it over with sticks and paper-bark, finally covering it all over with sand except a small aperture on the side, through which they crawl ; and then, stuffing the hole with grass, they lie all night in this substitute for a mosquito-net, packed like herrings.

These natives, beside the flint-headed spears, use a sharp hunting spear, two different kinds of boomerang, one, which is irregularly shaped, being used for striking fish in shallow water, and a large wooden shield slightly curved inwards at the ends. Their scanty dress only differs from that of the inland men in being a pearl shell ground down into an oval, and fastened round the waist with a hair band. Their language seems to be compounded of several dialects, as they often have two or three words for the same thing. *Marboo*, inland, means good ; *libe* is good also on the coast. *Nunity* and *curdimen* both mean dead. They can only count to four—*winjarrar*, one ; *coojarra*, two ; *coojarra-lina*, three ; *coojarra-coojarra*, four ; after which, though the number may be five or fifty, the word is all the same. Some words have been invented since the white men came into the country, as *cookenjerrie*, sheep ; *bulaman*, a cow ; *yowder*, a horse ; and *chilaman*, a gun. The woolshed is *lamingar-miar* ; *lamingar* hair, and *miar* a house (the hair-house). *Millie* means white ; thus, *Millie-millie* means a letter or book. Some of their words have quite a musical sound, as *minnewarrar*, by-and-bye ; *jimerillia*, all the same as. They

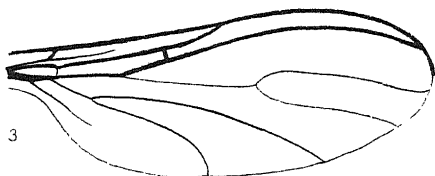
have separate names for the heavenly bodies : sun, *walgur* ; moon, *bingar* ; stars, *lun* ; milky-way, *gurdie*. For several of the most interesting facts about these natives I am indebted to Mr. James Gunn, manager of the King's Sound Pastoral Company, and Mr. Geo. Rose, of the Yeida Station, Kimberley.



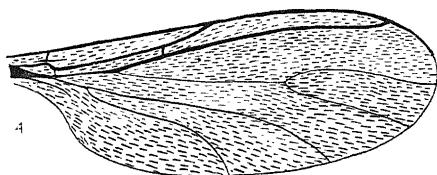
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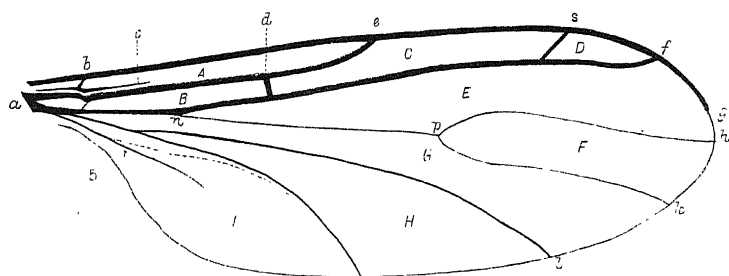
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DIPTERA OF AUSTRALIA.

BY FREDERICK A. A. SKUSE.

PART II.—THE SCIARIDÆ.

(Plate XI.)

This contribution, like its predecessor, in no way pretends to be more than an introductory review of the group; but in making immediate use of such material as has been collected, however inadequately that may represent the actual extent of the Australian Sciaridæ, this beginning may at least furnish a basis for future advancement.

The amount of work hitherto done amongst the Sciaridæ of this continent, is evidenced by the record of only a single species, namely *S. reciproca*, Walk., the description of which is absolutely useless, and it is questionable if the name attached to Mr. Walker's type-specimen should be retained, unless the species be re-described.

It is somewhat remarkable that the naturalists of the "Novara" and "Eugenie" expeditions in their collections of Australian Diptera did not obtain here any Sciaridæ, or even examples of the next family, the Mycetophilidæ, more particularly as these two groups elsewhere, and some equally obscure and small flies here, were not completely overlooked.

From the appended descriptions it will be seen that 42 species are enumerated and described as new; if to these must be added Mr. Walker's species, it brings the total up to 43, but this must bear only a small proportion to the unknown number of forms prevalent in the neighbourhood of Sydney alone. The family is no doubt largely represented in Australia, though

apparently not so numerous as the Cecidomyidæ, but no peculiar Australian genera have been yet detected ; with the exception of one species which I refer to the genus *Trichosia*, Winn., all belong to the typical genus *Sciara*, Meig.

A large proportion of the species described in the following pages were obtained by Mr. Masters and myself whilst searching for Cecidomyidæ, and therefore the result cannot be regarded as consequent upon very special research ; had the latter been the case, the number would no doubt have been augmented extensively.

My attention has been so completely occupied with the collection and description of the perfect insects that little opportunity has favoured an investigation of the life-histories and young stages of the Sciaridæ ; however, I hope the time may not be long postponed when I shall be able to supplement this imperfect work with accounts of these, but to ascertain the complete life-history of individual species is alone the work of months. Meanwhile I have given general descriptions of the larva and pupa stages, entirely summarized from the works of the few authors who have at all studied them, and I hope that the information will tend to direct the attention of students to this most neglected but deeply interesting group, the species of which during the young stages of their existence especially demand our consideration.

In the descriptions I sometimes employ the words "apparently no pubescence," by which I mean that no hair is made visible through the application of an ordinary entomological lens, but is rendered so when submitted to a working microscope of moderate amplification ; indeed but for the latter even the longitudinal rows of pubescence on the thorax of many species could not be made out. I use the term "petiole" to mean that portion of the third longitudinal vein between its origin and the base of its fork ; and "fork" is always an abbreviation for fork of the third longitudinal vein.

CLASSIFICATION OF THE SCIARIDÆ.

The Sciariidæ* form the second family of the Nematocerous Diptera, and at present comprise seven genera, *Sciara*, Meig.; *Trichosia*, Winn.; *Cratyna*, Winn.; *Corynoptera*, Winn.; *Bradysia*, Winn.; *Epidapus*, Hal.; and *Zygoneura*, Meig.; including a large number of species, which in their form and colour vary but little from a common character; indeed, all but a few known species are absorbed by the typical genus *Sciara*.

The genus *Sciara* was founded by Meigen in Illiger's Magazine, (II., p. 263, No. 12). Shortly afterwards Latreille gave this genus the name of *Molobrus*, and although Meigen's name, from its priority, is the rightly accepted one, Westwood, as late as 1840 (Mod. Class. Ins. II.) retains *Molobrus* and discards *Sciara* as a synonym.

During the year 1830, Meigen (Syst. Besch. VI. Suppl.) described several additional European species of *Sciara*, which he primarily classified according to a very limited estimation of the venation in the wings, while the ultimate separation of the species was entirely restricted to the consideration of coloration. In this imperfect method of dealing with such peculiarly approximate and persistent forms, Meigen was more or less followed by other authors, and as an inevitable consequence, the determination of the species described by these authors, is not only a matter fraught with great difficulty and uncertainty, but in many cases their identification is altogether impossible.

Before 1867, the genera *Sciara*, *Epidapus*, and *Zygoneura* oscillated in an irregular manner between two distinct families, the Cecidomyidæ and the Mycetophilidæ, their affinities being regarded with such uncertainty by Dipterologists. Meigen (Syst. Besch. I., XXXVI.) placed *Sciara* in a tribe by itself which he designated Tipulariæ lugubri, and he located this tribe between

* From *σκιαρος*, shaded.

T. fungicolæ (Mycetophilidæ), and *T. latipennes* (Simulidæ). Macquart (Hist. Nat. Ins. Dip. I., p. 121,) classed *Sciara* with the *T. fungicolæ*, but *Zygoneura* found a place with the *T. gallicolæ*; he nevertheless remarks that *Zygoneura* approaches the *T. fungicolæ* by the venation of the wings. Halliday included all three genera, together with the genera constituting the sub-family LESTREMINA of the Cecidomyidæ, amongst the Mycetophilidæ. Loew, in 1862 (Mon. Dipt. N. America I., p. 13), also puts *Sciara* in the Mycetophilidæ, but observes that it differs most from the rest of the family, and shows some affinity with Cecidomyidæ. With regard to *Epidapus*, this author says that "it is quite impossible to place it among the Mycetophilidæ, as Walker does, if we characterize the families as we have done; it rather seems to find its place among the Cecidomyidæ." *Zygoneura* is regarded by both Loew and Osten-Sacken as belonging to the second section of the Cecidomyidæ. Again, Schiner admits *Sciara*, *Epidapus* and *Zygoneura* into the Mycetophilidæ, the genera of which he arranges under two sub-families SCIARINA and MYCETOPHILINA.

Winnertz in 1867 (V. z.-b. G., Wien, Band XVIII.) came to the rescue, and published a monograph of the European Sciaridæ, in which he described 157 new species, and re-described 30 species of previous authors. To this indefatigable Dipterologist we are indebted for an exhaustive investigation of the three genera which had hitherto been the source of such perplexity. Not only did he establish five new genera and characterize the whole as forming a distinct family, but he elaborated a system of classification for the species, and pointed out what characteristics are possessed by the individual parts of their structure.

The chief divisions of Meigen are split up into sub-divisions based upon the colours of the halteres and palpi, and into further sections by the position of the cross-vein, and into sub-sections by

the position of the tip of the second longitudinal and the tip of the lower branch of the fork of the third longitudinal vein, which with rare exceptions are found constant in each species.*

In the ultimate separation of species, characters were found in the length of the costal vein beyond the tip of the second longitudinal vein, as compared with the distance between the tip of the former and that of the anterior branch of the third longitudinal fork; also that the relative distances between the tip of the posterior branch of the third longitudinal fork and the tip of the anterior branch of the fourth longitudinal fork, and this latter from the tip of its posterior branch, were valuable to notice. Besides the consideration of the alar-vein system, Winnertz also has shown that the relative lengths of joints of the legs are important in specific distinction.

With reference to the two main divisions of *Sciaræ*, Winnertz adds a note of which the following is a translation:—"In some species the tip of the sub-costal (first longitudinal) vein joins the costa opposite or beyond the root of the fork in the ♀ and in front in the ♂; in a few species its position, as well also that of the cross-vein, is not at all constant. In these cases the respective species are mentioned according to their deviation in the corresponding division, but they are described in that division to which they belong according to their majority."

Winnertz (Mon. der Sciarinen, p. 10), after characterising the family Sciaridæ draws attention to the close affinity of this group with the Mycetophilidæ, but at the same time gives the following diagnosis of the characters which supply effective points of distinction, and he justly concludes that these deviations give the Sciaridæ a type so different from that of the Mycetophilidæ, that a combination of the two groups must appear inadmissible.

* Winnertz adds, "the position of the tips is determined by drawing a straight line from the middle of the base of the wing through the apex, upon which, as the foundation, perpendicular lines are drawn from the respective points."

1. The position of the head, which is placed less deep in the prothorax.
2. The shape and character of the antennæ.
3. The less high and less acclivous metathorax.
4. The less elongated coxæ.
5. The strongly developed holding forceps of the ♂.
6. The shorter sub-marginal (first longitudinal) vein.
7. The medial vein (the portion of the second longitudinal behind the cross-vein) which is close to the sub-marginal (first longitudinal) vein and nearly always running parallel with it.
8. The fork (of the third longitudinal vein) which is always long-stalked, and generally coming from the middle of the medial vein (the portion of the second longitudinal behind the cross-vein).

As far as the small number of Australian species known to me are concerned, the system employed by Winnertz has been found perfectly serviceable; it only remains to be seen what new divisions fresh forms may require, but it appears to me probable that very little diversity, if any, will be found, judging from the general conformity of those I now describe. However, from my necessarily limited acquaintance at present with the totality of our species, there is little need for me to give expression to any views on the distribution of the group.

CHARACTERS OF THE FAMILY.

THE TRANSFORMATIONS.

I. *Larva*.

The larva is slender, cylindrical, smooth and shining, more or less translucent, white, pale yellow or citron-coloured, and composed of 13 segments. The head is considered the first segment, the three following segments represent the thorax, and the nine remaining constitute the abdomen. Stigmata scarcely visible,

arranged a little above the lateral line, one pair on the first thoracic segment and a pair on each segment of the abdomen except the two last. Pseudopodia on the thoracic division and the last abdominal segment; the abdominal segments are also provided with minute pads which are evidently to assist progression. Head black, small, retractile, furnished with a labrum, a pair of transverse dentate mandibles, maxillæ, a somewhat indistinct labium and rudimentary antennæ. Perris, in his description of the larval form of *S. convergens*, notices "a round areola above the insertion of the mandibles which appeared to be the seat of a completely invisible antenna." In giving an account of the larva of *S. Bigoti*, Laboulbène remarks that when disturbed the grubs move themselves with vivacity; their bodies becoming viscous when they are seized. They also have the power of stiffening and straightening themselves. As far as I have been able to ascertain comparatively little has been done towards a knowledge of the young stages of the Sciaridæ, and but few of their life-histories have been completely worked out. The study of the mouth-parts is regarded as a very difficult one, and there is a considerable amount of uncertainty, amongst capable judges, concerning other organs, as is evinced by their discordant opinions.

As a general rule the larvæ are gregarious, and their food is of a vegetable character, though there are instances of their being found in dung. Laboulbène found the larvæ above referred to in a flower-pot filled with ordinary manure which was peopled already with the larvæ of *Aphodius fimetarius*, and he tells us that they prefer that part where the manure is most moist. Perris found *S. convergens* under bark, amidst the excrements and detritus left by the larvæ of a species of *Tomicus*, of which it made its food; and the same author bred two other species, one from a twig previously inhabited by the larvæ of *Tomicus ramulorum* and *Anobium longicorne*, and the second from a decaying stump full of the dejections and detritus of other larvæ. A large number of larvæ mentioned by Winnertz in his monograph of the family were obtained from under the bark of trees, in decaying vegetable matter, old wood; others were found in manure

and fungi. Westwood (Mod. Class. Ins. II.) says that he has observed the "transformations of several species of *Molobrus*, Latr. (*Sciara*, Meig.), the larvæ and pupæ of which are found under the bark of felled trees, or at the root of decayed vegetables." Olivier (Prem. Mém. sur quelques Ins. qui attaquent les Céréales, 1813) bred three species of *Sciara* from wheat. Macquart (Hist. Nat. des Insectes Dipt. I.) says that the larvæ of *Sciara* develop in the earth; this is confirmed by Schiner (In Beitr. Mon. der Sciarinen von Joh. Winnertz), when he declares that the garden soil is seldom free from them. To undergo their metamorphosis into the pupa state some of the larvæ construct a cocoon, but others do not; of four species mentioned by Bouché only one makes a cocoon. Dufour (Ann. des Sc. Nat. 2nd Ser. t. 12, 1839), in a paper on the metamorphoses of Diptera, describes the stages of *S. ingenua*, the larva of which constructs a cocoon. According to Perris, *S. convergens* envelopes itself in a whitish, pellucid cocoon, which it makes in the detritus. The cocoon is not formed of filaments, but of a mucous substance which the larvæ secrete, after the manner of those of *Sciophila*.

II. Pupa.

The pupa is naked, oblong, and exhibits a general appearance of the different parts of the imago,—the eyes, antennæ, rudimentary wings and the feet being plainly distinguishable. The pupa is at first yellowish-white, amber-yellow, orange or pale reddish; afterwards the above-mentioned organs become brown. Two more or less distinct horns appear near the base of the antennæ in most pupæ. Surface of the abdomen minutely shagreened, with microscopic asperities, the last segment bifid. Stigmata generally indistinct. The thorax splits for the whole of its length on the emergence of the imago. The pupæ have a close resemblance to those of the Cecidomyidæ.

III. Habits and habitats of the perfect insects.

The perfect insects are obtainable in Australia all the year round, but the greatest number of species and individuals have been obtained in the neighbourhood of Sydney during the spring of the

year. They seem to chiefly haunt shady situations, and have been frequently found in caves associated with *Cecidomyidæ*, *Tipulidæ*, etc., but never to my knowledge have they been seen to voluntarily attach themselves to cob-webs in the manner observed amongst their near relatives, the gall-gnats; on the contrary, I have frequently taken both struggling and dead specimens from webs. A large number of *Sciaridæ* may be found flying about underneath dense bushes, on logs, round tree-trunks, and amongst grass, but as their habitats are for the most part umbrageous, these small, often minute, sombre-coloured flies are rendered difficult of detection, and consequently their collection is scarcely an easy matter. An inspection of windows generally rewards the collector of *Diptera* with an abundance of small flies, especially if the windows overlook a garden or rural expanse; I have in this way obtained in one afternoon specimens of a score or more species, the *Cecidomyidæ* and *Sciaridæ* being chiefly represented. Insects which could otherwise be followed only with a remote chance of success, even by one possessing remarkably acute eye-sight, are readily seen on a window, and their capture is easily accomplished. The flight of the *Sciaridæ* greatly resembles that of the *Cecidomyidæ*, and it is often impossible to distinguish between the two, more particularly if the individual be small.

With regard to the geographical distribution of *Sciaridæ*, I might mention that examples of the genus *Sciara* have been recorded from all the great continents, and many islands more or less remote from the mainland. They appear to be generally diffused over the earth's surface, occurring in arctic, temperate and tropical regions. About thirty species have been named from North America, and almost as many from South America; others are known from Africa, South Asia and the Eastern Islands, and Professor Hutton has described one species from New Zealand. According to Van der Wulp, *Sciara thomæ*, Linn., a European species, occurs also in Sumatra. Of the other genera only one, *Trichosia*, as far as I know, has been detected out of Europe, with a single species from North America, and another described by me in the present paper, but, this far from demonstrates a restricted range.

IV. *Imago.**External structure.*

Head small, above broader than long, round when viewed from the front, narrower than the thorax. Hypostoma and front broad. Eyes reniform, broader below than above, approaching on the front or contiguous. Ocelli three, arranged in a triangle on the vertex, the lower one smaller than the upper two. Proboscis short, thick, usually slightly projecting; large suctorial labella. Palpi prominent, incurved, four-jointed; first joint very small; second and third joints nearly of equal length, the former generally narrowed at the base, the latter sub-cylindrical or elliptical; the fourth joint slender, elongate; more or less densely covered with most microscopic pubescence, generally sparingly setose, apparently never glabrous. Antennæ arcuated, projecting forward, generally short, 2- + 14-jointed; the joints of the scapus almost bare, prominent, the first joint cyathiform, cupuliform or sub-cylindrical, the second cyathiform; the flagellar joints cylindrical or ovate, densely pubescent, often verticillate-setose; generally sub-sessile, the pedicels rarely very distinct, sometimes sessile. Thorax ovate, gibbose, with two or three longitudinal rows of setaceous-hairs, more or less interspersed with short fine hairs; the lateral margins between the origin of the wings and the humeri generally with long setaceous hairs, also a few on the scutellum; no transverse suture; scutellum small. Halteres * large, with microscopic pubescence, usually very sparingly setose; altogether wanting in *Epidapus*. Legs long, frequently very long, slender. Coxæ somewhat elongate, except in *Epidapus*, with a more or less sparse setaceous pubescence in front. Femora moderately robust, with a shallow furrow on the inner side, covered with microscopic pubescence, setose in front. Tibiæ and tarsi very densely covered

*Winnertz says, "Schwinger unbedeckt," but this is not the case even though we may not recognize their often dense microscopic pubescence.

with microscopic pubescence; the former with or without lateral spines, and having terminal spurs, the latter furnished with weakly developed ungues, the pulvilli being small, scarcely perceptible, or altogether wanting. Wings longer or shorter than the abdomen, incumbent, generally rounded at the base and apex, but sometimes cuneiformly narrowed at the former; microscopically haired, rarely distinctly pubescent; ciliated round the margin; pellucid, more or less deeply tinted with different shades of brown, and occasionally hyaline; generally beautifully iridescent; altogether wanting in *Epidapus*. Costal vein never quite reaching the apex of the wing, its termination distinct. The number of longitudinal veins amounts to four, though often a rudimentary fifth is more or less distinctly perceptible immediately behind the fourth; the third and fourth longitudinal veins furcate. First and second longitudinal veins and costal vein very distinct. First longitudinal vein short, joining the anterior margin either before, at, or a little beyond the middle of the costal vein, or before, over, or somewhat beyond the base of the fork of the third longitudinal vein. Cross-vein usually distinct, situated either before, at, or beyond the middle of the first longitudinal vein. Second longitudinal vein always terminating at some point in the margin before the tip of the costal vein, seldom forming a fork near the tip by sending out a short anterior branch into the costa; that portion before the cross-vein nearly always running parallel to the first longitudinal. Third longitudinal vein usually originating about midway between the base of the second longitudinal and the cross-vein; generally pale and more or less indistinct; the petiole always long, often longer than the anterior branch of the fork; branches of the fork inclined posteriorly, more or less undulated, and both reaching the margin below the tip of the costal vein, the tip of the anterior branch being sometimes at, but never before, the apex of the wing; the base of the fork more or less cuneiform, rarely bulbous. Fourth longitudinal vein generally pale, branching near the base. A distinct longitudinal wing-fold lies between the fourth and rudimentary fifth longitudinal veins, much nearer the former. Abdomen composed of seven segments,

clothed with a short pubescence; in the ♂ almost cylindrical, more or less dilated towards the middle, with strongly developed holding-forceps; in the ♀ acuminate, the ovipositor provided with small terminal lamellæ.

The Sciariidæ generally present a uniform livery of some shade of brown or black, and in the venation of the wings strikingly remind us of the Cecidomyidæ belonging to the sub-family LESTREMINA, and of the Mycetophilidæ in their generally microscopically pubescent membrane. The largest known Australian example measures nearly five lines in expanse, and the smallest rather more than a line.

The following synopsis is appended to set forth Winnertz's distribution of the genera :—

A. Flagellar joints of the antennæ cylindrical, pedicelled, or sessile.

SCIARA, Meig.—Wings longer than the abdomen, their surface microscopically pubescent; wing-lobes more or less developed. Joints of the antennæ pubescent.

TRICHOSIA, Winn.—Wings as in *Sciara*, but their surface distinctly hairy.

CRATYNA, Winn.—Wings as in *Sciara*, but the cubitus (second longitudinal vein) united with the costa by a radial vein.

CORYNOPTERA, Winn.—Wings claviform, their surface microscopically pubescent; antennæ of the ♂ pedicelled, verticillate.

BRADYSIA, Winn.—Wings narrow, shorter than the abdomen, their surface microscopically pubescent.

EPIDAPUS, Hal.—Wings and halteres wanting.

B. Flagellar joints of the antennæ in the ♂ ovate, with long pedicels, in the ♀ cylindrical, sessile.

ZYGONEURA, Meig.—Wings as in *Sciara*, but the large fork bellied at the base and its branches undulated

The following is a tabulation of the Australian species of *Sciara*.

I. FIRST LONGITUDINAL VEIN JOINING THE COSTA OPPOSITE OR BEYOND THE BASE OF THE FORK.

(Nos. 96 to 99).

A. Halteres black or brown, the stalk wholly or partly yellow, yellowish or whitish.

(Nos. 96 to 98).

1. Palpi black or brown.

(Nos. 96 to 98).

A. Cross-vein situated before the middle of the first longitudinal vein.

a. *Tip of the second longitudinal vein nearer the apex of the wing than the tip of the posterior branch of the fork.*

(No 96).

C. Cross-vein situated beyond the middle of the first longitudinal vein.

c. *Tip of the posterior branch of the fork nearer the apex of the wing than the tip of the second longitudinal vein.*

(Nos. 97 and 98).

B. Halteres yellow or whitish.

(No. 99).

II. FIRST LONGITUDINAL VEIN JOINING THE COSTA BEFORE THE BASE OF THE FORK.

(Nos. 100 to 136).

A. Halteres black or brown, the stalk wholly or partly yellow, yellowish or whitish.

(Nos. 100 to 134).

1. Palpi black or brown.

(Nos. 100 to 122).

B. Cross-vein situated at the middle of the first longitudinal vein

b. *Tip of the second longitudinal vein and tip of the posterior branch of the fork equally near the apex of the wing.*

(No. 100).

C. Cross-vein situated beyond the middle of the first longitudinal vein.

a. *Tip of the second longitudinal vein nearer the apex of the wing than the tip of the posterior branch of the fork.*

(Nos. 101 to 104).

† *Thorax with two longitudinal rows of hairs.*

(Nos. 101 and 102).

†† *Thorax with three longitudinal rows of hairs.*

(Nos. 103 and 104).

b. *Tip of the second longitudinal vein and tip of the posterior branch of the fork equally near the apex of the wing.*

(Nos. 105 and 106).

c. *Tip of the posterior branch of the fork nearer the apex of the wing than the tip of the second longitudinal vein.*

(Nos. 107 to 122).

† *Thorax with two longitudinal rows of hairs.*

(Nos. 107 to 110).

†† *Thorax with three longitudinal rows of hairs.*

(Nos. 111 to 122).

2. Palpi yellow.

(Nos. 123 to 134).

B. Cross-vein situated at the middle of the first longitudinal vein.

b. *Tip of the second longitudinal vein and tip of the posterior branch of the fork equally near the apex of the wing.*

(No. 123).

c. *Tip of the posterior branch of the fork nearer the apex of the wing than the tip of the second longitudinal vein.*

(No. 124).

C. Cross-vein situated beyond the middle of the first longitudinal vein.

a. *Tip of the second longitudinal vein nearer the apex of the wing than the tip of the posterior branch of the fork.*

(No. 125).

b. *Tip of the second longitudinal vein and tip of the posterior branch of the fork equally near the apex of the wing.*

(Nos. 126 to 130).

c. *Tip of the posterior branch of the fork nearer the apex of the wing than the tip of the second longitudinal vein.*

(Nos. 131 to 134).

B. Halteres yellow or whitish.

(Nos. 135 and 136).

1. Palpi black or brown.

(No. 135).

B. Cross-vein situated at the middle of the first longitudinal vein.

c. *Tip of the posterior branch of the fork nearer the apex of the wing than the tip of the second longitudinal vein.*

(No. 135).

2. Palpi yellow.

(No. 136).

C. Cross-vein situated beyond the middle of the first longitudinal vein.

b. *Tip of the second longitudinal vein and tip of the posterior branch of the fork equally near the apex of the wing.*

(No. 136).

Genus 1. SCIARA, Meigen.

Sciara, Meigen, Illiger's Magazine II., 263 (1803); *Molobrus*, Latreille, N. Dict. d'H. n. (1804); *Sciara*, Macquart, Hist. n. des Ins. Dipt. I., p. 147 (1834); Zetterstedt, Dipt. Scand.; Walker, I., B.; Schiner, F.A. Dipt., 1864; Winnertz, V. z.-b. G., Wien, Band xviii., p. 11.

Head small, roundish, front somewhat flattened; hypostoma and front broad. Eyes reniform, broader below than above, approaching on the front, or contiguous. Ocelli three, arranged in a triangle on the vertex, the lower one smaller than the two upper ones. Proboscis slightly projecting. Palpi short, prominent, four-jointed, the first joint very small, second and third joints almost of equal lengths, the last joint more or less elongate. Antennæ arcuated, projecting forward, 2-+14-jointed, always longer in the ♂ than in the ♀; the joints of the scapus cyathiform, almost bare, those of the flagellum cylindrical, pubescent, sessile or sub-sessile, the last joint elliptical or elongate. Thorax ovate, gibbose; scutellum small. Halteres large, with a microscopic pubescence, usually very sparingly setose. Abdomen seven-segmented, in the ♂ almost cylindrical or more coniform, with holding-forceps; in the ♀ acuminate; ovipositor generally long, with terminal lamellæ. Legs slender, frequently very long. Coxæ somewhat elongate. Femora with a shallow furrow on the inner side. Tibiæ with small spurs, with or without lateral spines. Last joint of the tarsi with pulvilli. Wings large, microscopically hairy, rounded at the base and apex. Fork of the third longitudinal vein more or less cuneiformly narrowed towards the base. Fifth longitudinal vein imperfect or altogether wanting.

I. FIRST LONGITUDINAL VEIN JOINING THE COSTA OPPOSITE OR BEYOND THE BASE OF THE FORK.

A. Halteres black or brown, the stalk wholly or partly yellow, yellowish or whitish.

1. Palpi black or brown.

A. Cross-vein situated before the middle of the first longitudinal vein.

a. *Tip of the second longitudinal vein nearer the apex of the wing than the tip of the posterior branch of the fork.*

96. *SCIARA MACLEAYI*, sp.n. (Pl. XI., fig. 1).

♂.—Length of antennæ.....	0·075 inch	...	1·89 millimètres.
Expanse of wings.....	0·180 × 0·065	...	4·56 × 1·66
Size of body.....	0·150 × 0·030	...	3·81 × 0·76
♀.—Length of antennæ.....	0·050 inch	...	1·27 millimètres.
Expanse of wings.....	0·180 × 0·065	...	4·56 × 1·66
Size of body.....	0·200 × 0·035	...	5·08 × 0·88

♂.—Antennæ deep reddish-brown, with a short yellowish pubescence; rather slender, half the length of the body; basal joints with a very sparse pubescence; flagellar joints sub-sessile, 2 to 3 times as long as broad, densely pubescent. Head black, sub-nitidous. Eyes almost contiguous above. Palpi deep brown. Thorax black, sub-nitidous, with three almost parallel rows of brown hairs reaching nearly to the scutellum, also some long hairs along the lateral margins from the humeri; humeri indistinctly tipped with reddish-brown; pleuræ deep umber-brown; scutellum rather densely covered with long hairs. Halteres entirely umber-brown sprinkled with short hairs. Abdomen black or very deep brown, densely clothed with a moderately long brown pubescence; as broad as the thorax; forceps wider than the abdomen, umber-brown densely covered with a short pubescence. Legs deep umber-brown, all the joints densely pubescent. In the fore-legs the tarsi somewhat longer than the tibiæ; in the intermediate and hind-legs the tibiæ a little longer than the tarsi. Spurs shorter than the fourth tarsal joint. First joint of the tarsi $2\frac{1}{2}$ times the

length of the second; second joint about $\frac{1}{4}$ longer than the third and shorter than the fourth and fifth together; fourth joint considerably shorter than the fifth. Wings pellucid, with an almost fuliginous tint, the costal and two first longitudinal veins deep brown; brilliant roseous and smaragdine reflections when viewed at a certain obliquity. First longitudinal reaching the costa a short distance beyond the base of the fork and opposite to the tip of the anterior branch of the fourth longitudinal vein; petiole paler than the fork and longer than the anterior branch; posterior branch short and nearly straight; tips scarcely divergent. *fg** the same length or almost imperceptibly shorter than *gh*; *kl* rather more than $\frac{2}{3}$ the length of *lm*.

♀.—Antennæ short, rather slender, not as long as the head and thorax combined; flagellar joints sub-sessile, very little longer than broad, but towards the end about $\frac{1}{4}$ longer than broad; terminal joint twice as long as broad. Abdomen obscure castaneous; lamellæ of the ovipositor deep brown, elliptical. *fy* slightly longer than *gh*; *kl* about $\frac{2}{3}$ the length of *lm*. The remainder as in the ♂.

Hab.—Lawson and Glenbrook, Blue Mountains, also Bowral (Masters); Manly, near Sydney (Skuse).

C. Cross-vein situated beyond the middle of the first longitudinal vein.

c. Tip of the posterior branch of the fork nearer the apex of the wing than the tip of the second longitudinal vein.

97. SCIARA SEDULA, sp.n. (Pl. XI., fig. 2).

♀.—Length of antennæ.....	0·050 inch	...	1·27 millimètres.
Expanse of wings.....	0·130 × 0·050	...	3·30 × 1·27
Size of body.....	0·120 × 0·020	...	3·04 × 0·50

* The letters *f*, *g*, *h*, *k*, *l*, *m* have been adopted by Winnertz to indicate the tips of the second longitudinal, the costal, the anterior and posterior branches of the fork of the third longitudinal, and those of the fourth longitudinal respectively. This will be made clear by reference to the diagram on plate XI.

Antennæ deep brown, with a short pale yellowish pubescence; slender, rather longer than the head and thorax combined; joints of the scapus very sparsely haired; flagellar joints sub-sessile, twice as long as broad, the terminal joint 3 times longer than broad. Head black, levigate. Eyes contiguous above. Palpi deep reddish-brown. Thorax black, levigate, with two longitudinal rows of brown hairs reaching almost to the scutellum, also some long hairs between the humeri and the base of the wings; humeri very slightly tipped with deep reddish-brown; scutellum black or deep brown, levigate, with long hairs. Halteres brown, sparsely haired. Abdomen very deep reddish-brown, sometimes appearing almost black. Coxæ black or very deep brown, with long brown hairs on the front. Femora, tibiæ and tarsi very obscure pitch-brown, densely haired. In the fore-legs the tibiæ and tarsi of almost equal length; in the intermediate and hind-legs the tibiæ a little longer than the tarsi. Spurs honey-yellow, about the same length as the fourth tarsal joint. First joint of the tarsi 3 times the length of the second; second joint $\frac{1}{2}$ longer than the third; third and fifth joints of equal length and $\frac{1}{3}$ longer than the fourth. Wings pellucid with a greyish-brown tint, somewhat pointed at the apex; brilliant smaragdine, rosy, and golden reflections when viewed at a certain obliquity. Costal and two first longitudinal veins almost cinereous. First longitudinal vein reaching the costa immediately opposite the base of the fork; cross-vein very distinct; petiole thicker and less distinct than the fork, shorter than the posterior branch; both branches thicker and less distinct at their base, running almost parallel to one another, slightly divergent at their tips, the posterior branch less arcuated at the base than the anterior one. *fg* three times the length of *gh*; *kl* somewhat shorter than *lm*.

Hab.—Gosford (Skuse). February.

98. SCIARA SORORIA, sp.n.

♀.—Length of antennæ.....	0.040 inch	...	1.01 millimètres,
Expand of wings.....	0.095 × 0.040	...	2.39 × 1.01
Size of body.....	0.080 × 0.015	...	2.02 × 0.38

Antennæ deep brown, with short yellowish pubescence; slender, half the length of the body; joints of the scapus very sparsely haired; flagellar joints sub-sessile, very little longer than broad at the base, towards the tip twice as long as broad, the terminal joint longer. Head black. Eyes contiguous above. Palpi black, or very deep brown. Thorax black, levigate, with two rather indistinct rows of short hairs from the collare to the scutellum; scutellum black or deep brown, levigate, with long hairs. Halteres brown, with short, sparse pubescence, the stalk sordid ochraceous. Abdomen black, with a moderately long, somewhat dense pubescence; lamellæ of the ovipositor black, elliptical. Legs pitch-brown. In the fore-legs the tarsi a little longer than the tibiæ; in the intermediate-legs the tibiæ somewhat longer than the tarsi; in the hind-legs the tibiæ about a quarter longer than the tarsi. Spurs honey-yellow, longer than the fourth tarsal joint. First joint of the tarsi rather more than twice the length of the second; second joint somewhat longer than the third; third and fifth joints of equal length, and one-third longer than the fourth. Wings pellucid, almost fuliginous, with the costal and two first longitudinal veins almost black; weak opaline reflections. First longitudinal vein reaching the costa immediately opposite the base of the fork; cross-vein very indistinct, situated immediately beyond the middle of the first longitudinal; petiole paler than the fork, shorter than the posterior branch; branches running almost parallel to one another, scarcely divergent at their tips, the posterior branch very little arcuated. *fg* rather more than three times the length of *gh*; *kl* a little shorter than *lm*.

Hab.—North Waratah, near Newcastle (Skuse). May.

B. Halteres yellow or whitish.

99. *SCIARA RECIPROCA*, Walker.

Sciara reciproca, Walker, *Insecta Saundersiana*, Vol. I. Diptera, 1856, p. 420.

“♀.—*Nigra, obscura; abdomen piceo-nigrum, thorace duplo longius; pedes graciles, sat longi; alæ cinereæ.*

“Black, dull. Abdomen piceous-black, about twice the length of the thorax. Legs slender, moderately long. Wings grey; radial vein and cubital vein black; the rest paler; basal part of the subapical vein longer than its fork. Length of the body, $1\frac{1}{2}$ line; of the wings, 3 lines.

“Van Diemen’s Land.”

Obs.—Without a re-description of this species it is impossible to say to what section or sub-section it may be referred, but Walker places it in the sub-division “b” of Meigen’s division “A,” which corresponds to its present position.

II. FIRST LONGITUDINAL VEIN JOINING THE COSTA BEFORE THE BASE OF THE FORK.

A. Halteres black or brown, the stalk wholly or partly yellow, yellowish or whitish.

1. Palpi black or brown.

B. Cross-vein situated at the middle of the first longitudinal vein.

b. *Tip of the second longitudinal vein and tip of the posterior branch of the fork equally near the apex of the wing.*

100. SCIARA FINITIMA, sp.n.

♀.—Length of antennæ..... 0·055 inch ... 1·39 millimètres.
 Expanse of wings..... 0·140 × 0·050 ... 3·55 × 1·27
 Size of body..... 0·130 × 0·030 ... 3·30 × 0·76

Antennæ pitch-brown, with a dense pale yellow pubescence; not very slender, and not quite as long as the head and thorax together; basal joints deep brown with a somewhat sparse, minute pubescence; flagellar-joints sub-sessile, 2 to 3 times as long as broad. Head black. Eyes contiguous above. Palpi black. Thorax black, levigate, with three longitudinal rows of short yellowish hairs which extend from the collare almost to the

scutellum, and a few long yellowish-brown hairs between the wings and the humeri; scutellum black, with a few long hairs on the posterior margin. Halteres pitch-brown, the base of the stalk ochraceous; club sparsely covered with short hairs. Abdomen ochraceous-brown, the dorsal segments laterally inclined to fuscous, and the four terminal segments with the lamellæ of the ovipositor almost umber brown; lamellæ almost elliptical. Legs pitch-brown. In the fore-legs the tarsi a little longer than the tibiæ; in the intermediate legs the tibiæ and tarsi of about equal length; in the hind-legs the tibiæ $\frac{1}{6}$ longer than the tarsi, and $\frac{1}{3}$ longer than the tibiæ of the intermediate-legs. Spurs yellowish, as long as the last joint of the tarsi. First tarsal joint in the two first pairs of legs rather more than twice the length of the second joint, in the hind-legs more than three times the length; second joint $\frac{1}{3}$ longer than the third, and about equal in length to the fourth and fifth joints together. Wings pellucid with a pale greyish-brown tint; brilliant margaritaceous reflections when viewed at a certain obliquity. First longitudinal vein joining the costa almost opposite but immediately before the base of the fork of the third longitudinal vein; petiole indistinct, and rather shorter than the anterior branch; anterior branch twice as arcuated at the base as the posterior; both branches scarcely divergent at the tips. *fg* about $1\frac{2}{3}$ times the length of *gh*; *kl* about the same length as *lm*.

Hab.—Glenbrook (Masters). End of November.

C. Cross-vein situated beyond the middle of the first longitudinal vein.

a. *Tip of the second longitudinal vein nearer the apex of the wing than the tip of the posterior branch of the fork.*

† *Thorax with two longitudinal rows of hairs.*

101. *SCIARA ÆMULA*, sp.n. (Pl. XI, fig. 3).

♀.—Length of antennæ.....	0·065 inch	...	1·66 millimètres.
Expanse of wings.....	0·180 × 0·065	...	4·56 × 1·66
Size of body.....	0·160 × 0·030	...	4·06 × 0·76

Antennæ black, with a short yellowish pubescence; rather longer than the head and thorax together; joints of the scapus with very little pubescence; flagellar joints sub-sessile, 2 to $2\frac{1}{2}$ times as long as broad, densely pubescent. Head black, levigate. Eyes almost contiguous above. Palpi deep brown, Thorax black, levigate, with two longitudinal and almost parallel rows of short brown hairs, extending almost to the scutellum, also some moderately long hairs along the lateral margins from the humeri; humeri slightly tipped with reddish-brown; scutellum with some moderately long hairs. Halteres entirely umber-brown, sprinkled with short hairs. Abdomen deep umber with the last two joints black, densely covered with a moderately long brown pubescence; as broad as the thorax; lamellæ of the ovipositor black, densely pubescent, elliptical. Coxæ black or very deep brown, with some rather long hairs on the front. Femora, tibiæ and tarsi deep umber-brown, densely pubescent. In the fore and intermediate legs the tarsi somewhat longer than the tibiæ; in the hind legs the tibiæ and tarsi of equal length. First joint of the tarsi 3 times the length of the second; second joint $\frac{1}{6}$ longer than the third and considerably shorter than the fourth and fifth together; third and fifth joints of about equal length, and longer than the fourth. Wings pellucid with a greyish-brown tint, the costal and two first longitudinal veins deep umber-brown; brilliant roseous and smaragdine reflections when viewed at a certain obliquity. First longitudinal vein reaching the costa almost opposite but immediately before the base of the fork of the third longitudinal; petiole paler than the fork and rather shorter than the posterior branch; posterior branch shorter than the anterior one, very little arcuated at the base; both branches slightly divergent at the tips. *fg* about twice the length of *gh*; *hl* about $\frac{3}{4}$ the length of *lm*.

Hab.—Elizabeth Bay and Middle Harbour (Skuse). September.

Obs.—In size, general appearance, and colour this species greatly resembles *S. Macleayi*, for which at first sight it might very easily be mistaken, but the length and narrowness of the

fork of the third longitudinal vein (third sub-marginal cell) is at once a distinguishing character visible to the naked eye. I have only taken a single specimen in each of the above-named localities.

102. *SCIARA LUCTIFICA*, sp.n.

♂.—Length of antennæ.....	0.075 inch	...	1.89 millimètres.
Expanse of wings.....	0.140 × 0.050	...	3.55 × 1.27
Size of body.....	0.120 × 0.025	...	3.04 × 0.62

Antennæ pitch-brown, with a yellowish-brown pubescence; rather slender; more than half the length of the wings; basal joints pitch-brown, with a very sparse but longer pubescence than that on the flagellar joints; flagellar joints sub-sessile, $1\frac{1}{2}$ to $2\frac{1}{2}$ times as long as broad. Head black. Eyes contiguous above. Palpi pitch-brown. Thorax black or very deep brown, levigate with two indistinct longitudinal rows of very short yellowish-brown hairs; pleuræ deep reddish-brown; scutellum with a very minute sparse pubescence. Halteres pitch-brown, yellowish at the base, with a most minute sparse pubescence; club large, pyriform. Abdomen pitch-brown, with a somewhat dense long yellowish-brown pubescence; considerably broader at the base than the thorax, the last four segments becoming narrower; forceps pitch-brown, densely pubescent, broader than the terminal segment of the abdomen. Legs pitch-brown, densely covered with a fine yellowish-brown pubescence; fore femora rather shorter than the intermediate ones, hind femora somewhat longer than the latter; intermediate tibiæ $\frac{1}{3}$ longer than the first, hind tibiæ slightly longer than the intermediate ones; spurs yellow, about as long as the fourth joint of the tarsi; tarsal joints of all the legs of about the same length, except that the first joint of the intermediate and hind tarsi is rather more than $\frac{1}{6}$ longer than that of the fore tarsi; second joint of the tarsi $\frac{1}{3}$ longer than the fourth; third joint just perceptibly longer than the fifth. Wings with a very pale somewhat reddish-brown tint, reflecting brilliant opaline colours when viewed at a certain obliquity. Petiole much paler than the fork and shorter than the anterior branch; tip of the anterior branch

straight, tip of the posterior branch bent a little posteriorly. *fg* twice the length of *gh*; *kl* almost $\frac{1}{4}$ shorter than *lm*. Rudimentary fifth longitudinal vein close behind the fourth longitudinal vein disappearing at about $\frac{3}{4}$ of its length.

Hab.—Gawler, South Australia.

†† *Thorax with three longitudinal rows of hairs.*

103. SCIARA FROGGATTI, sp.n.

♂.—Length of antennæ.....	0·065 inch	...	1·66 millimètres.
Expanse of wings.....	0·110 × 0·045	...	2·79 × 1·13
Size of body.....	0·100 × 0·015	...	2·54 × 0·38

Antennæ black or deep brown, with a yellowish pubescence; slender, about $\frac{3}{5}$ the length of the body; joints of the scapus sparsely haired; flagellar joints sub-sessile, 2 to 3 times as long as broad, the terminal joint about $\frac{1}{3}$ longer than the one immediately preceding it. Head black. Eyes not contiguous above. Palpi black. Thorax black, levigate, with three rows of short hairs extending from the collare almost to the scutellum; scutellum with a few moderately long hairs. Halteres black, somewhat brownish at the base of the stem, with a few very short hairs on the club. Abdomen black, slender, somewhat sparingly covered with a moderately long brownish pubescence; forceps large, wider than the abdomen, densely pubescent. Legs deep umber-brown, appearing almost black, particularly the tarsal joints. In the fore- and middle-legs the tarsi about $\frac{1}{5}$ longer than the tibiæ; in the hind-legs the tibiæ and tarsi of about equal length. Spurs short, honey-yellow. First joint of the tarsi in the fore- and intermediate legs 3 times the length of the second, in the hind-legs rather more than twice the length; second joint $\frac{1}{4}$ longer than the third; third joint $\frac{1}{2}$ longer than the fourth and a little longer than the fifth. Wings pellucid, almost fuliginous, with the costal and two first longitudinal veins nearly black; weak roseous and smaragdine reflections. First longitudinal reaching the costa some distance

before the base of the fork; cross-vein very distinct; petiole paler than the fork, longer than the anterior branch; anterior branch rather more arcuated than the posterior one; both branches slightly divergent at the tips; branches of fourth longitudinal vein darker than the last. *fg* twice the length of *gh*; *kl* about equal in length to *lm*.

Hab.—Middle Harbour (Froggatt). April.

104. *SCIARA FREQUENS*, sp.n.

♂.—Length of antennæ.....	0·060 inch	...	1·54 millimètres.
Expanse of wings.....	0·110 × 0·045	...	2·79 × 1·13
Size of body... ..	0·100 × 0·015	...	2·54 × 0·38

Antennæ black, with a minute brownish-yellow pubescence; rather slender, more than half the length of the body; basal joints black, almost without any pubescence; flagellar joints with very short pedicels, 2 to 4 times as long as broad, the terminal joint considerably longer than the one immediately preceding it. Head black. Eyes almost contiguous above. Palpi light brown. Thorax dull black or deep brown, with three longitudinal and almost parallel rows of very minute golden-yellow single hairs; scutellum with a short pubescence, the hairs longer than those on the thorax. Halteres light umber-brown, the base of the stalk pale brownish-yellow, with sparse and minute pubescence; club large, pyriform. Abdomen deep umber-brown, with a very sparse, short, golden-yellow pubescence; almost cylindrical, rather narrower than the thorax; forceps very large, rather densely pubescent. Coxæ and femora very pale brownish-yellow, the coxæ somewhat darker than the femora, the former with a few short yellow hairs on the upper side, and the latter with a minute pale pubescence also only on the upper side. Trochanters light brown, considerably darker than the coxæ and femora. Tarsi almost cinereous, but having a yellowish tinge. In the fore-legs the tarsi are about one-third longer than the tibiæ, in the intermediate-legs the tarsi are somewhat longer than the tibiæ, and in

the hind-legs the tibiæ are a very little longer than the tarsi. First tarsal joint nearly $2\frac{1}{2}$ times longer than the second, the second joint $\frac{1}{3}$ longer than the third, and as long as the fourth and fifth together. Wings cinereous, with brilliant pale green and rosy reflections. First longitudinal joining the costa immediately before the base of the fork of the third longitudinal vein; petiole much paler than the fork, and considerably shorter than the anterior branch; branches slightly divergent at the tips. *fg* $\frac{2}{3}$ longer than *gh*; *kl* somewhat shorter than *lm*.

Hab.—Sydney (Skuse). February.

b. *Tip of the second longitudinal vein and tip of the posterior branch of the fork equally near the apex of the wing.*

105. SCIARA DOLOSA, sp.n.

♀.—Length of antennæ.....	0·045 inch	...	1·13 millimètres.
Expanse of wings	0·110 × 0·045	...	2·79 × 1·13
Size of body.....	0·100 × 0·020	...	2·54 × 0·50

Antennæ pitch-brown, with a yellow pubescence; rather slender, about half the length of the body; basal joints pitch-brown, with a very sparse pubescence; flagellar joints sub-sessile, all but the terminal joint twice as long as broad, the latter one half longer than the preceding. Head black. Eyes almost contiguous above. Palpi dusky-brown. Thorax black, levigate, with three longitudinal rows of short brown hairs from the collare to the scutellum, also a patch of long hairs between the wings and the humeri; scutellum with a somewhat sparse minute pubescence. Halteres dull pitch-brown, the base of the stem sordid ochraceous. Abdomen black on the dorsal segments, underneath umber-brown, sparsely pubescent; in the middle about as broad as the thorax; the lamellæ of the ovipositor black, oblong. Coxæ and femora testaceous, both darker on the upper side on account of their pubescence. Tibiæ and tarsi pitch-brown, the latter somewhat darker than the former, with a dense pubescence.

In the fore-legs the tarsi about $\frac{1}{4}$ longer than the tibiae; in the intermediate-legs the tarsi and tibiae of about equal length; and in the hind-legs the tibiae somewhat longer than the tarsi. Spurs about the same length as the last joint of the tarsi, yellowish-brown. First tarsal joint rather more than twice the length of the second; the second $\frac{1}{4}$ longer than the third, and almost as long as the fourth and fifth together; fourth tarsal joint somewhat longer than the fifth. Wings almost hyaline, having a pale brownish tint, with brilliant reflections, in which blue predominates, when viewed at a certain obliquity. First longitudinal vein reaching the costa a very short distance before the base of the fork. Petiole rather paler than the fork and shorter than the anterior branch; posterior branch considerably less arcuated at the base than the anterior one, and almost in a line with the petiole; both branches very slightly divergent at the tips. *fg* rather more than twice the length of *gh*; *kl* a little shorter than *lm*.

Hab.—Elizabeth Bay, near Sydney (Skuse). December.

106. SCIARA FESTINA, sp.n.

♀.—Length of antennæ.....	0·040 inch	...	1·01 millimètres.
Expanse of wings.....	0·090 × 0·040	...	2·27 × 1·01
Size of body.....	0·090 × 0·020	...	2·27 × 0·50

Antennæ pitch-brown, with a pale yellow pubescence; slender, as long as the head and thorax together; basal joints dull castaneous, with a sparse but considerably longer pubescence than that of the flagellum; flagellar joints sub-sessile, twice as long as broad, with minute pedicels. Head black. Eyes contiguous above. Palpi yellowish-brown. Thorax black, levigate, with three double longitudinal rows of short hairs, nearly meeting just in front of the scutellum, also some long hairs between the wings and the humeri; humeri tipped with dull reddish-brown; scutellum black, with numerous short dispersed hairs. Halteres pitch-brown, the stem ochraceous,

with a few minute hairs about the basal portion of the club. Abdomen somewhat dull castaneous, with a short pubescence; broader at the base and middle than the thorax; lamellæ of the ovipositor pitch-brown, elliptical. Legs pitch-brown. In the fore-legs the tarsi $\frac{1}{6}$ longer than the tibiæ; in the intermediate-legs the tarsi $\frac{1}{7}$ longer than the tibiæ; in the hind-legs the tibiæ somewhat longer than the tarsi. Spurs the same length as the last tarsal joint. First joint of the tarsi $2\frac{1}{2}$ times as long as the second, rather longer in the fore tarsi; second joint $\frac{1}{4}$ longer than the third and almost as long as the fourth and fifth joints together; two last joints of equal length. Wings pellucid, with a very pale greyish-brown tint, and having brilliant azure reflections when viewed at a certain obliquity. Veins pale yellowish brown. First longitudinal vein reaching the costa a short distance before the base of the fork; cross-vein somewhat ill-defined, slender; petiole most indistinct, and longer than the anterior branch of the fork; branches directed downwards, their tips slightly divergent; the posterior branch considerably shorter than the anterior. *fg* about $\frac{1}{2}$ longer than *gh*; *kl* almost the same as *lm*.

Hab.—Sydney (Masters and Skuse).

c. *Tip of the posterior branch of the fork nearer the apex of the wing than the tip of the second longitudinal vein.*

† *Thorax with two longitudinal rows of hairs.*

107. SCIARA PERNITIDA, sp.n.

♂.—Length of antennæ.....	0·100 inch	...	2·54 millimètres.
Expanse of wings.....	0·100 × 0·035	...	2·54 × 0·88
Size of body	0·100 × 0·015	...	2·54 × 0·38
♀.—Length of antennæ.....	0·060 inch	...	1·54 millimètres.
Expanse of wings.....	0·140 × 0·045	...	3·55 × 1·13
Size of body.....	0·120 × 0·025	...	3·04 × 0·62

♂.—Antennæ slender, as long as the body, dark reddish-brown, with a minute pale pubescence; basal joints with very little pubescence; flagellar joints sub-sessile, 4 to 6 times as long as

broad, the terminal joint considerably longer than the one immediately preceding it. Head black, sub-nitidous. Eyes non-contiguous above but very close. Palpi brown. Thorax black, very nitidous, with two longitudinal rows of minute hairs, slightly convergent, and not extending as far as the scutellum, also some long hairs between the humeri and the base of the wings; scutellum deep brown, sub-nitidous, with two or three long hairs. Halteres pitch-brown, the base of the stem ochraceous. Abdomen black, with a short moderately dense pubescence, slender; forceps considerably broader than abdomen, densely pubescent. Legs pitch-brown. In the fore-legs the tarsi rather more than $\frac{1}{4}$ longer than the tibiae; in the intermediate-legs the tarsi almost $\frac{2}{5}$ longer than the tibiae; and in the hind-legs the tarsi $\frac{1}{5}$ longer than the tibiae. Spurs yellowish, as long as the last tarsal joint. First joint of the tarsi twice the length of the second; second $\frac{1}{4}$ longer than the third joint, and rather longer than the fourth and fifth together; fourth somewhat longer than the fifth. Wings pellucid, with a very pale somewhat reddish-brown tint and brilliant opaline reflections; veins pale reddish-brown. First longitudinal vein reaching the costa considerably before the base of the fork; petiole very little paler than the fork, and almost as long as the anterior branch; posterior branch very little arcuated at the base, and both slightly divergent at the tips. *fy* more than 4 times the length of *gh*; *kl* rather longer than *lm*.

♀.—Antennae half the length of the body, joints $2\frac{1}{2}$ to 3 times as long as broad. Abdomen robust; lamellae of the ovipositor brown, short, almost elliptical. Legs much darker than in the ♂. In the fore- and intermediate-legs the tarsi not quite $\frac{1}{4}$ longer than the tibiae; in the hind-legs the tarsi a little longer than the tibiae.

Hab.—Elizabeth Bay (Masters and Skuse); Glenbrook, Blue Mountains (Masters). November.

Obs.—It is remarkable that we should have taken this species only in the two above-named and widely separate localities, where it occurs very abundantly.

108. *SCIARA FAMILIARIS*, sp.n.

♂.—Length of antennæ.....	0·030 inch	...	0·76 millimètre.
Expanse of wings.....	0·070 × 0·030	...	1·77 × 0·76
Size of body.....	0·070 × 0·012	...	1·77 × 0·30
♀.—Length of antennæ.....	0·027 inch	...	0·88 millimètre.
Expanse of wings.....	0·080 × 0·030	...	2·02 × 0·76
Size of body.....	0·080 × 0·015	...	2·02 × 0·38

♂.—Antennæ very slender, deep brown, with a dense pale pubescence; joints of the scapus black, sparsely haired; flagellar joints $1\frac{1}{4}$ to $1\frac{1}{2}$ times as long as broad, five times as long as the pedicels. Head black. Eyes contiguous above. Palpi brown. Thorax black, levigate, with two longitudinal double rows of short sparse hairs running almost to the scutellum; a few longer hairs between the origin of the wing and the humeri, also on the scutellum. Halteres umber brown, the base of the stem ochraceous-yellow; short sparse pubescence on the club. Abdomen umber-brown, sordid ochraceous between the segments, with a moderately long, rather dense, pubescence; forceps and terminal segment almost black, the former wider than the two segments immediately preceding them, very densely haired. Legs greyish-brown. In the fore- and intermediate-legs the tarsi a little longer than the tibiae; in the hind-legs the tibiae slightly longer than the tarsi. Spurs as long as the fourth tarsal joint. Fourth joint of the tarsi $2\frac{1}{2}$ times the length of the second; second joint $\frac{1}{4}$ longer than the third and almost equal in length to the fourth and fifth combined; third joint somewhat longer and considerably thicker than the fifth, and about $\frac{1}{3}$ longer than the fourth. Wings almost hyaline, with a very pale greyish-brown tint; veins light umber-brown; brilliant violaceous and purpureous reflection when viewed at a certain obliquity. First longitudinal vein reaching the costa a short distance before the root of the fork, and opposite to the tip of the posterior branch of the fourth longitudinal; cross-vein very distinct, a little beyond the middle of the first longitudinal vein; petiole more indistinct than the fork, rather shorter

than the posterior branch; branches running parallel for the greater part of their length, scarcely divergent at the tips, the posterior branch very little arcuated at the base, and almost straight; branches of the fourth longitudinal vein considerably more distinct than the third longitudinal. *fg* three times the length of *gh*; *kl* almost imperceptibly shorter than *lm*.

♀.—Antennæ about as long as the head and thorax together; flagellar joints sub-sessile, $1\frac{1}{4}$ to $2\frac{1}{4}$ times as long as broad, the pedicels very minute; terminal joint longer and thicker than the preceding; joints of the scapus brown. Abdomen wider than the thorax, almost cylindrical, uniform umber-brown, rather sparsely pubescent; lamellæ of the ovipositor small, oval, black or deep brown, with a very short dense pubescence. Branches of the fork of the third longitudinal vein not running so parallel to one-another as in the ♂ but gradually divergent.

Hab.—Elizabeth Bay (Skuse). January.

109. SCIARA CAVATICA, sp.n.

♂.—Length of antennæ..... 0.030 inch ... 0.76 millimètre.

Expanse of wings..... 0.075×0.025 ... 1.89×0.62

Size of body..... 0.065×0.015 ... 1.66×0.38

Antennæ pitch-brown, with a bright yellowish-brown pubescence; slender, about half the length of the body; basal joints rather paler than those of the flagellum, and not so thickly haired; flagellar joints sub-sessile, the pedicels more distinctly visible towards the tip where they are about $\frac{1}{4}$ to $\frac{1}{5}$ the length of the joints; all but the terminal joint about one-half longer than broad, the latter being about one-half longer than the preceding; pilose. Head black. Eyes contiguous above. Thorax black, or deep brown, levigate, with two longitudinal double rows of short yellowish-brown hairs; humeri slightly tipped with ochraceous; scutellum pitch-brown, with some yellowish reflections on the posterior border, sparsely covered with a moderately long yellowish pubescence. Halteres pitch brown, ochraceous at the base of the stem, with a minute

pubescence. Abdomen umber-brown, moderately clothed with yellowish hairs; at the base rather narrower than the thorax, gradually dilated towards the middle; forceps large, densely haired. Legs ochraceous-brown; the coxæ, tibiæ and tarsi densely pubescent; femora darker on the upper side on account of their pubescence. In the fore-legs the tarsi about $\frac{1}{5}$ longer than the tibiæ; in the intermediate-legs both of equal length; in the hind-legs the tibiæ about $\frac{1}{3}$ longer than the tarsi. Spurs ochraceous-brown, as long as the fourth tarsal joint. First tarsal joint three times the length of the second; second $\frac{1}{4}$ longer than the third; third and fifth the same length and $\frac{1}{3}$ longer than the fourth joint. Wings pellucid, with a pale yellowish-brown tint, and brilliant azure and violaceous reflections when viewed at a certain obliquity. Costal and first and second longitudinal veins very distinct, yellowish-brown; the rest of the veins indistinct. First longitudinal vein reaching the costa a very short distance before the base of the fork; cross-vein very thick; petiole rather shorter than the posterior branch of the fork; branches not divergent at their tips; tip of the posterior branch very little nearer the apex of the wing than the tip of the second longitudinal vein. *fg* four times the length of *gh*; *kl* almost the same as *lm*.

Hab. — Glenbrook, Blue Mountains (Masters). End of November.

110. SCIARA FESTIVA, sp.n.

♂.—Length of antennæ... ..	0·030 inch	...	0·76 millimètre.
Expanse of wings.....	0·070 × 0·030	...	1·77 × 0·76
Size of body.....	0·060 × 0·012	...	1·54 × 0·30
♀.—Length of antennæ.....	0·025 inch	...	0·62 millimètre.
Expanse of wings.....	0·070 × 0·030	...	1·77 × 0·76
Size of body.....	0·065 × 0·015	...	1·66 × 0·38

♂.—Antennæ slender, half the length of the body, umber-brown with a short dense yellowish pubescence; joints of the scapus sparsely pubescent; flagellar joints sub-sessile, towards the

tip about one-half longer than broad, the terminal joint more slender, about $3\frac{1}{2}$ times as long as broad. Head black, levigate. Eyes contiguous above. Palpi light brown. Thorax black, levigate, with two indistinct longitudinal double rows of very short hairs reaching nearly to the scutellum; scutellum deep reddish-brown, with a short stiff pubescence. Halteres brown, the stalk brownish-yellow, club with a few scattered very short hairs. Abdomen broader than the thorax, black, rather densely clothed with a moderately long pubescence; forceps black, densely pubescent, a little wider than the abdomen. Legs ochraceous-brown, the tibiæ and tarsi darker than the rest. In the fore-legs the tarsi a very little longer than the tibiæ; in the intermediate legs the tibiæ almost imperceptibly longer than the tarsi; and in the hind-legs the tibiæ nearly $\frac{1}{3}$ longer than the tarsi. Spurs about as long as the fourth tarsal joint. First joint of the tarsi in the first and second pairs of legs about $2\frac{1}{2}$ times the length of the second, in the hind-legs 3 times the length; second joint somewhat longer than the third; third joint somewhat longer than the fifth. Wings pellucid, with a very pale yellowish-brown tint; brilliant blue and purpureous reflections. First longitudinal vein reaching the costa a short distance before the root of the fork; cross-vein very indistinct; third longitudinal vein almost uniformly indistinct, the petiole shorter than the lower branch of the fork; branches running almost parallel for the quarter part of their length, scarcely divergent at the tips; the posterior branch very little arcuated at the base; fork of the fourth longitudinal vein more distinct than the last. *fg* almost $3\frac{1}{2}$ times the length of *gh*; *kl* about equal to *lm*.

♀.—Antennæ slender, as long as the head and thorax together, the pubescence short, not quite so dense as in the ♂; flagellar joints very little longer than broad, the terminal joint about 3 times as long as wide. Lamellæ of the ovipositor small, black, densely pubescent, ovate.

Hab.—Elizabeth Bay (Skuse). May.

††. *Thorax with three longitudinal rows of hairs.*

111. *SCIARA MÆSTA*, sp.n.

♂.—Length of antennæ.....	0·100 inch	...	2·54 millimètres.
Expanse of wings.....	0·120 × 0·45	...	3·04 × 1·13
Size of body.....	0·100 × 0·015	...	2·54 × 0·38

♀.—Length of antennæ.....	0·060 inch	...	1·54 millimètres.
Expanse of wings.....	0·160 × 0·055	...	4·06 × 1·39
Size of body.....	0·140 × 0·030	...	3·55 × 0·76

♂.—Antennæ somewhat thick, deep brown, with a long dense yellowish pubescence; basal joints black, with a sparse pubescence; flagellar joints sub-sessile $1\frac{1}{2}$ to 3 times as long as broad, with short pedicels. Head black, levigate. Eyes almost contiguous above. Palpi deep brown or black. Thorax black, levigate, with three longitudinal rows of very short hairs, the lateral ones slightly convergent, and running almost as far as the scutellum, the intermediate one only visible when viewed at a certain obliquity, reaching to the middle of the thorax; also some short hairs between the base of the wings and the humeri; humeri tipped with deep reddish-brown; scutellum deep brown almost black, with a very sparse short pubescence. Halteres greyish-brown, with a few short hairs, the stem yellow. Abdomen slender, black, with moderately long golden-yellow hairs, the pubescence considerably more dense on the last three or four segments; forceps densely haired, very little if any wider than the abdomen. Fore coxæ honey-yellow, dusky at the base; middle and hind coxæ deep brown or black. Femora honey-yellow. Tibiæ and tarsi darker, partly on account of their pubescence, almost pitch-brown. In the fore- and intermediate-legs the tarsi $\frac{1}{4}$ longer than the tibiæ; in the hind-legs the tibiæ are slightly longer than the tarsi. Spurs yellow, about equal in length to the fourth tarsal joint. First joint of the tarsi more than twice the length of the second; second joint $\frac{1}{3}$ longer than the third, and about as long as the fourth and fifth together; fifth joint somewhat longer than the fourth. Wings pellucid, with a pale greyish-brown tint; opaline reflections. Costal and two first longitudinal

veins brown ; very distinct. Cross-vein thick. First longitudinal vein reaching the costa some distance before the base of the fork ; petiole somewhat paler than the fork and longer than the anterior branch ; posterior branch shorter than the anterior and very little arcuated at its base ; tips scarcely divergent. *fg* three times the length of *gh* ; *kl* a little longer than *lm*.

♀.—Antennæ rather slender, pitch-brown, with a moderately long dense yellowish pubescence ; basal joints pitch-brown, somewhat paler than those of the flagellum, with a sparse pubescence ; flagellar joints 2 to 4 times as long as broad, sub-sessile. Halteres brown, with a few hairs, the stem brownish-yellow. Abdomen deep brown or black ; lamellæ of the ovipositor deep brown or black, elliptical. First joint of the tarsi 3 times the length of the second ; second joint about $\frac{1}{2}$ longer than the third, and not quite the length of the combined fourth and fifth joints ; fifth joint about $\frac{1}{2}$ longer than the fourth.

Hab.—Middle Harbour, near Sydney (Skuse) ; Berowra (Masters). August.

112. SCIARA AQUILA, sp.n.

♀.—Length of antennæ.....	0·040 inches	...	1·01 millimètres.
Expanse of wings.....	0·140 × 0·050	...	3·55 × 1·27
Size of body.....	0·120 × 0·020	...	3·04 × 0·50

Antennæ black, with a short yellowish pubescence ; slender, as long as the head and thorax combined ; joints of the scapus black, sparsely pubescent ; flagellar joints sub-sessile, 2 to $2\frac{1}{2}$ times as long as broad. Head black. Eyes contiguous above. Palpi deep brown. Thorax black, sub-nitidous, with three longitudinal rows of golden-yellow pubescence, the lateral rows starting from the humeri, extending almost to the scutellum and nearly meeting, the hairs becoming less dense towards the scutellum ; the intermediate row very short and indistinct, sparsely haired ; a few lateral hairs in front of the origin of the wings, not extending to the humeri ; humeri very slightly tipped with reddish-brown ; scutellum with

a few moderately long, golden-yellow hairs. Halteres almost fuscous with the stem pitch-brown, with no visible pubescence. Abdomen umber-brown, appearing almost black in a certain light, with a very short pubescence; lamellæ of the ovipositor umber-brown, elliptical. Legs pitch-brown. In the fore-legs the tarsi almost imperceptibly longer than the tibiæ; in the intermediate legs the tibiæ a little longer than the tarsi; in the hind-legs the tibiæ $\frac{1}{2}$ longer than the tarsi. Spurs yellowish, equal in length to the fourth tarsal joint. First joint of the tarsi 3 times the length of the second; second joint $\frac{1}{4}$ longer than the third and shorter than the fourth and fifth combined; third and fifth joints about the same length and $\frac{1}{4}$ longer than the fourth. Wings pellucid, with a pale greyish-brown tint with brilliant roseous and smaragdine reflections. Costal and first two longitudinal veins somewhat reddish-brown. Cross-vein very distinct, narrower than the second longitudinal. First longitudinal vein joining the costa almost opposite the base of the fork of the third longitudinal vein; petiole paler than the fork, and shorter than than its posterior branch; posterior branch less arcuated at the base than the anterior one; branches running almost parallel, slightly divergent at their tips; tip of the posterior branch very little nearer the apex of the wing than the tip of the second longitudinal vein. *fg* twice the length of *gh*; *kl* about $\frac{1}{2}$ the length of *lm*.

Hab.—Glenbrook (Masters). November.

Obs.—I have only seen two specimens.

113. SCIARA AUDAX, sp.n.

♀.—Length of antennæ.....	0.050 inch	...	1.27 millimètres.
Expanse of wings.....	0.110 × 0.040	...	2.79 × 1.01
Size of body	0.110 × 0.020	...	2.79 × 0.50

Antennæ slender, nearly half the length of the body, black, with a minute pale pubescence; joints of the scapus black, sparsely pubescent; flagellar joints sub-sessile, about $2\frac{1}{2}$ times

as long as broad, the terminal joint longer. Head black. Eyes contiguous above. Palpi black or very deep brown. Thorax black, levigate, with three longitudinal rows of golden-yellow hairs, the intermediate one a single row of short hairs, rather indistinct, reaching almost as far as the other two, the lateral rows double, with somewhat longer hairs extending almost to the scutellum; also some long golden-yellow hairs just anterior to the origin of the wings; scutellum sparsely covered with long golden-yellow hairs. Halteres deep pitch-brown, with a very short sparse pubescence, the stem paler. Abdomen wider than the thorax, deep pitch-brown, somewhat paler between the segments, covered with a very short yellowish pubescence; lamellæ of the ovipositor small, oval. Coxæ deep pitch-brown, ferruginous at the apex, and with some rather long yellowish hairs on the upper side. Femora deep pitch-brown with a tolerably dense, short pubescence. Tibiæ and tarsi almost fuliginous on account of their dense pubescence. In the fore-legs the tarsi about $\frac{1}{6}$ longer than the tibiæ; in the intermediate legs the tarsi somewhat longer than the tibiæ; and in the hind-legs the tibiæ and tarsi are of about equal length. Spurs about the length of the fourth tarsal joint. First joint of the tarsi about $2\frac{1}{2}$ times the length of the second; second joint nearly $\frac{1}{4}$ longer than the third; third joint $\frac{1}{2}$ longer than the fourth, and somewhat longer than the fifth joint. Wings pellucid with an almost fuliginous tint; costal and two first longitudinal veins obscure brown; brilliant margaritaceous reflections. First longitudinal vein reaching the costa a short distance before the base of the fork and a little beyond the tip of the posterior branch of the fourth longitudinal vein; cross-vein distinct, a short distance beyond the middle of the first longitudinal; petiole very pale and indistinct, shorter than the posterior branch of the fork; branches running almost parallel for the greater part of their length, slightly divergent at the tips; the posterior branch very little arcuated at the base. *fg* nearly $3\frac{1}{2}$ times the length of *g h*; *kl* shorter than *lm*.

Hab.—Elizabeth Bay (Masters). May.

114. *SCIARA VECORS*, sp.n.

♀.—Length of antennæ.....	0.050 inch	...	1.27 millimètres.
Expanse of wings.....	0.100 × 0.030	...	2.54 × 0.76
Size of body	0.080 × 0.015	...	2.02 × 0.38

Antennæ rather slender, black, with a minute, very dense, pale pubescence; joints of the scapus sparsely haired; flagellar joints sub-sessile, 2 to $2\frac{1}{2}$ times as long as broad. Palpi black or deep brown. Eyes contiguous above. Head black, sub-nitidous. Thorax black, sub-nitidous, with three longitudinal double rows of short pale hairs, the intermediate one indistinct, reaching to the middle of the thorax, the lateral ones running almost to the scutellum, also some long hairs between the scutellum and the humeri; scutellum with some long hairs. Halteres deep brown, the stem paler brown, with apparently no pubescence. Abdomen black, rather sparsely covered with a short pale pubescence; lamellæ of the ovipositor black, oval. Legs obscure pitch-brown, the coxæ almost black. In the fore-legs the tarsi are a little longer than the tibiæ; in the intermediate-legs the tibiæ and tarsi are of almost equal length; and in the hind-legs the tibiæ are a very little longer than the tarsi. Spurs as long as the fifth tarsal joint. First joint of the tarsi about $2\frac{1}{2}$ times the length of the second; second joint almost $\frac{1}{4}$ longer than the third and nearly equal to the fourth and fifth together; third joint $\frac{1}{3}$ longer than the fourth and somewhat longer than the fifth. Wings almost hyaline, with a very pale greyish-brown tint, the veins light umber-brown; brilliant rosy and blue margaritaceous reflections when viewed at a certain obliquity. First longitudinal vein reaching the costa a short distance before the base of the fork and a little beyond the tip of the posterior branch of the fourth longitudinal vein; petiole considerably paler than the fork, and about equal in length to the anterior branch; branches running almost parallel, very slightly divergent at their tips; posterior branch very little arcuated at the base. *fg* rather more than $2\frac{1}{3}$ times the length of *gh*; *kl* about $\frac{3}{4}$ the length of *lm*.

Hab.—Tenterfield, New England (Skuse). February.

Obs.—The only specimen I have seen of this I took from a cobweb.

115. *SCIARA ERRATICA*, sp.n.

♀.—Length of antennæ..... 0·030 inch ... 0·76 millimètre.

Expanse of wings..... 0·085 × 0·030 ... 2·14 × 0·76

Size of body..... 0·090 × 0·015 ... 2·27 × 0·38

Antennæ slender, one-third the length of the body, black or deep brown, with a short dense yellowish pubescence; joints of the scapus brown, with a very short sparse pubescence; flagellar joints sub-sessile, 2 to $2\frac{1}{2}$ times as long as broad. Head black, with a short, rather sparse, yellowish pubescence. Eyes contiguous above. Palpi brown. Thorax black, levigate, with three longitudinal double rows of yellowish hairs, coalescent at the scutellum; a few lateral hairs before the humeri; scutellum black with some short yellowish hairs. Halteres pale brown, ochraceous at the base, with a few very short hairs. Abdomen deep umber-brown, pale between the segments, sparsely clothed with a moderately long yellowish pubescence; lamellæ of the ovipositor very small, umber-brown, elliptical, not very densely pubescent. Coxæ honey-yellow, with a few longish yellow hairs. Femora, tibiæ and tarsi ochraceous-brown, the two latter, particularly the terminal joints of the tarsi, darker on account of their dense pubescence. In the fore-legs the tarsi about $\frac{1}{2}$ longer than the tibiæ; in the intermediate-legs the tibiæ almost imperceptibly longer than the tarsi; in the hind-legs the tibiæ only a little longer than the tarsi. Spurs very short. First joint of the tarsi $2\frac{1}{2}$ times the length of the second; second joint $\frac{1}{2}$ longer than the third; third joint about $\frac{1}{3}$ longer than the fourth and a little longer than the fifth. Wings almost hyaline, with a yellowish tint, margaritaceous reflections when viewed at a certain obliquity. Veins yellowish-brown. First longitudinal vein reaching the costa considerably before the base of the fork, and about opposite to the tip of the posterior branch of the fourth longitudinal vein; cross-vein somewhat indistinct; petiole almost invisible, somewhat

shorter than the anterior branch of the fork ; branches of the fork running almost parallel, a little divergent at their tips, the posterior branch scarcely arcuated at its base. *fg* about $\frac{1}{4}$ longer than *gh* ; *kl* rather shorter than *lm*.

Hab.—Hexham (Skuse). April.

116. *SCIARA APPROXIMATA*, sp.n.

♀.—Length of antennæ.....	0·040 inch	...	1·01 millimètres.
Expansion of wings... ..	0·080 × 0·030	...	2·02 × 0·76
Size of body.....	0·075 × 0·015	...	1·89 × 0·38

Antennæ slender, deep brown, longer than the head and thorax together, with a short, dense, pale yellowish pubescence ; joints of the scapus deep brown, sparsely haired ; flagellar joints sub-sessile, twice as long as broad. Head black, nitidous, sparsely pubescent. Eyes non-contiguous but very close. Palpi ochraceous-brown. Thorax black, nitidous, with three indistinct longitudinal double rows of yellowish hairs, the lateral ones reaching almost to the scutellum ; also a few long hairs between the origin of the wings and the humeri, and on the scutellum. Halteres deep brown, almost black, ochraceous at the base of the stalk, club sprinkled with some very short hairs at the base. Abdomen very deep umber-brown, of a lighter shade between the segments, with a tolerably dense pubescence ; lamellæ of the ovipositor very small, brown, elliptical, with brownish-yellow pubescence. Coxæ and femora ferruginous-ochraceous. Tibiæ and tarsi dusky-brown. In the fore-legs the tarsi a little longer than the tibiæ ; in the intermediate-legs the tibiæ and tarsi of equal length ; in the hind-legs the tibiæ a little longer than the tarsi. Spurs very short. First joint of the tarsi 3 times the length of the second ; second joint a little longer than the third ; third and fifth joints of about equal length, and $\frac{1}{3}$ longer than the fourth. Wings pellucid, with a pale yellowish-brown tint ; brilliant margaritaceous reflections. Veins yellowish-brown. First longitudinal vein reaching the costa a short distance before

the base of the fork; cross-vein thick; petiole very pale, almost as long as the anterior branch of the fork; branches running almost parallel, a little divergent at the tips; posterior branch very little arcuated at the base. *fg* about 5 times the length of *gh*; *kl* shorter than *lm*.

Hab.—Sydney (Skuse). January.

117. *SCIARA EVANESCENS*, sp.n.

♀.—Length of antennæ.....	0·030 inch	...	0·76 millimètre.
Expanse of wings.....	0·080 × 0·030	...	2·02 × 0·76
Size of body	0·075 × 0·015	...	1·87 × 0·38

Antennæ slender, not as long as the head and thorax together, umber-brown, with a short, dense, yellowish pubescence; joints of the scapus lighter brown, sparsely pubescent; flagellar joints sub-sessile, $1\frac{1}{4}$ times as long as broad, the terminal joint very slender and almost twice the length of the joint immediately preceding it. Head black, levigate. Eyes contiguous above. Palpi light brown. Thorax deep brown, almost black, levigate, with three longitudinal double rows of brownish-yellow hairs, the intermediate row very indistinct, stopping before the middle, the lateral ones sparse, not extending quite to the scutellum and not coalescent; some long hairs between the origin of the wings and the humeri, also on the scutellum. Halteres deep brown, the base of the stalk brownish-yellow; a few very short hairs about the base of the club. Abdomen deep umber-brown, almost black on the last few segments, rather densely clothed with a moderately long pale pubescence; lamellæ of the ovipositor small, deep brown, oval. Legs pitch-brown, the tibiæ, and particularly the tarsi, darker on account of their dense pubescence. The tibiæ and tarsi of the fore-legs short, of equal length; in the intermediate-legs the tibiæ and tarsi a little longer than the last, the tibiæ being about $\frac{1}{2}$ longer than the tarsi; in the hind-legs the tibiæ $\frac{1}{2}$ longer than the tarsi. Spurs as long as the fourth tarsal joint. First joint of the tarsi in the fore- and intermediate-legs

$2\frac{1}{2}$ times, and in the hind-legs 3 times the length of the second ; second joint a little longer than the third ; third and fifth joints of about equal length and $\frac{1}{4}$ longer than the fourth. Wings pellucid, with a pale yellowish-brown tint ; reflecting brilliant æneous and chalybeous tints when viewed at a certain obliquity. First longitudinal vein reaching the costa a little before the base of the fork ; petiole very indistinct, somewhat shorter than the anterior branch of the fork ; branches pale, running almost parallel, slightly divergent at the tips, the posterior branch very little arcuated at the base. *fg* about 4 times the length of *gh* ; *kl* a little shorter than *lm*.

Hab.—Sydney (Skuse). December.

118. SCIARA SCITULA, sp.n.

♀.—Length of antennæ.....	0.035 inch	...	0.88 millimètre.
Expanse of wings.....	0.080 × 0.030	...	2.02 × 0.76
Size of body	0.070 × 0.015	...	1.77 × 0.38

Antennæ black or deep brown, with a minute pale pubescence ; slender, as long as the head and thorax combined ; joints of the scapus with a very sparse and minute pubescence ; flagellar joints sub-sessile, 2 to $2\frac{1}{2}$ times as long as broad, the terminal joint nearly 4 times as long. Head black, sub-nitidous. Eyes almost contiguous above. Palpi reddish-brown. Thorax black, sub-nitidous, with three longitudinal double rows of yellowish-brown hairs, the intermediate one somewhat indistinct, reaching only to the middle of the thorax, the lateral ones running almost as far as the posterior margin ; also a row of longer hairs on the lateral margins between the origin of the wings and the humeri ; scutellum with a few moderately long hairs. Halteres pitch-brown, a few short hairs on the club. Abdomen deep brown appearing almost black, with a short sparse yellowish-brown pubescence, dense at the extremity ; lamellæ of the ovipositor deep brown, small, oval. Coxæ honey-yellow. Femora, tibiæ and tarsi pitch-brown. In the fore- and intermediate-legs the tarsi somewhat longer than the tibiæ ; in the hind-legs

the tibiæ a little longer than the tarsi. Spurs shorter than the fourth tarsal joint. First joint of the tarsi rather more than twice the length of the second; second joint longer than the third; third and fifth joints of about equal length and about $\frac{1}{3}$ longer than the fourth. Wings pellucid, almost hyaline, with a very pale yellowish-brown tint; brilliant blue and purple reflections when viewed in a certain light. Veins pale yellowish-brown. First longitudinal vein joining the costa a short distance before the base of the fork; cross-vein distinct, considerably beyond the middle of the first longitudinal; petiole very pale and indistinct, about the same length as the anterior branch of the fork; branches gradually separating as they proceed to the margin, and slightly divergent at their tips; posterior branch very little arcuated, and very little nearer the apex of the wing than the tip of the second longitudinal vein. *fg* about $2\frac{1}{2}$ times longer than *gh*; *kl* rather shorter than *lm*

Hab.—Sydney (Skuse).

119.—*SCIARA BREVIFURCA*, sp.n.

♀.—Length of antennæ.....	0·030 inch	...	0·76 millimètre.
Expanse of wings.....	0·055 × 0·025	...	1·39 × 0·62
Size of body.....	0·050 × 0·015	...	1·27 × 0·38

Antennæ slender, rather more than half the length of the body, deep brown, almost black, with a short dense yellowish pubescence; joints of the scapus umber-brown, sparsely pubescent; flagellar joints a little longer than broad, the terminal joint nearly twice the length of the one immediately preceding it. Head black, levigate. Eyes almost contiguous. Palpi light umber-brown. Thorax deep brown, levigate, with three longitudinal double rows of short yellowish-brown hairs, the intermediate one very indistinct reaching only to about the middle, the lateral ones extending to the scutellum, but not coalescent; some moderately long hairs between the origin of the wings and the scutellum, also a few on the scutellum; scutellum umber-brown. Halteres umber-brown,

the base of the stalk yellowish, sprinkled with a few short hairs on the club. Abdomen faded olivaceous-brown on the dorsal segments, paler between the segments and underneath, sparsely clothed with a short pubescence; ovipositor dusky-brown, the lamellæ small, elliptical. Legs faded olivaceous-brown. In the fore-legs the tibiæ and tarsi are very short, the tarsi a little longer than the tibiæ; in both the intermediate- and hind-legs the tarsi somewhat longer than the tibiæ. Spurs very minute. First joint of the tarsi twice the length of the second; second joint somewhat longer than the third; third and fifth joints of equal length, each about $\frac{1}{4}$ longer than the fourth. Wings hyaline, the veins tinted with pale brownish; cupreous reflections when viewed at a certain obliquity. First longitudinal vein reaching the costa some distance before the base of the fork, and opposite to the tip of the posterior branch of the fourth longitudinal fork; cross-vein indistinct; third longitudinal vein, with its fork, indistinct; the petiole longer than the fork; fork very angular at the base, gradually widening to the margin of the wing, tips somewhat divergent; in some specimens the fork is most indistinct at the base; branches of the fourth longitudinal vein more distinct than the third longitudinal. *fg* rather more than twice the length of *gh*; *kl* somewhat shorter than *lm*.

Hab.—Elizabeth Bay (Skuse). January to May.

120. SCIARA DIVERSA, sp.n.

♀.—Length of antennæ.....	0.025 inch	...	0.62 millimètre.
Expanse of wings.....	0.060 × 0.025	...	1.54 × 0.62
Size of body.....	0.060 × 0.015	...	1.54 × 0.38

Antennæ very slender, nearly half the length of the body, deep umber-brown, with a short dense yellowish pubescence; joints of the scapus with a very short sparse pubescence; flagellar joints sub-sessile, near the tip about $\frac{1}{4}$ longer than broad, the terminal joint rather more than twice as long as broad. Head black. Eyes almost contiguous above. Palpi brown. Thorax black, sub-nitidous, with

three longitudinal double rows of short pale brownish hairs from the collare to the scutellum, also some long hairs between the origin of the wings and the scutellum; scutellum black, sub-nitidous, sparsely covered with a short pubescence, with two or three very long setæ. Halteres deep brown, the base of the stem almost ochraceous-brown, with no perceptible pubescence. Abdomen black or very deep brown, with a sparse covering of short, pale brownish, pubescence; lamellæ of the ovipositor rather small, ovate. Legs light pitch-brown. In the fore-legs the tibiæ and tarsi very short, the tarsi a little longer than the tibiæ; in the intermediate-legs the tibiæ and tarsi of about equal length; in the hind-legs the tibiæ about $\frac{1}{2}$ longer than the tarsi. Spurs about the same length as the fourth tarsal joint. First joint of the tarsi about $2\frac{2}{3}$ times as long as the second; second joint $\frac{1}{6}$ longer than the third; third joint $\frac{1}{3}$ longer than the fourth, and somewhat longer than the fifth. Wings hyaline, with brown veins and golden and roseous reflections. First longitudinal vein reaching the costa some distance before the base of the fork and about opposite the tip of the posterior branch of the fourth longitudinal fork; cross-vein distinct; petiole paler than the fork, and shorter than either branch; fork not pointed at the base, the branches running almost parallel for the greater part of their length, but divergent towards their tips, posterior branch slightly arcuated at the base; branches of the fourth longitudinal vein rather more distinct than the last. *fg* about $\frac{1}{5}$ longer than *gh*; *kl* about $\frac{5}{8}$ the length of *lm*.

Hab.—Elizabeth Bay (Masters). May.

121. *SCIARA MINUTELA*, sp.n.

♂.—Length of antennæ.....	0.030 inch	...	0.76 millimètre.
Expanse of wings.....	0.050 × 0.020	...	1.27 × 0.50
Size of abdomen	0.050 × 0.010	...	1.27 × 0.25
♀.—Length of antennæ.....	0.026 inch	...	0.62 millimètre.
Expanse of wings.....	0.055 × 0.020	...	1.39 × 0.50
Size of abdomen... ..	0.050 × 0.010	...	1.27 × 0.25

♂.—Antennæ slender, more than half the length of the body, deep umber-brown, with a short dense yellowish pubescence; joints of the scapus deep brown, rather sparsely pubescent; flagellar joints sub-sessile, twice as long as broad, the terminal joint one-half longer than the one immediately preceding it. Head black. Eyes contiguous above. Palpi yellow. Thorax black, levigate, with three longitudinal double rows of short yellowish hairs, the intermediate one stopping beyond the middle of the thorax, the lateral ones reaching the scutellum; a few hairs anterior to the origin of the wings and on the scutellum. Halteres deep brown, the base of the stalk somewhat paler, with a few short hairs. Abdomen black, or very deep brown, nearly as wide as the thorax, covered with short yellowish hairs; forceps not as wide as the abdomen, densely pubescent. Legs brownish-ochraceous. In the fore-legs the tarsi very slightly longer than the tibiæ; in the intermediate-legs the tarsi $\frac{1}{10}$ longer than the tibiæ; in the hind-legs the tibiæ almost imperceptibly longer than the tarsi. Spurs as long as the fourth tarsal joint. First joint of the tarsi $2\frac{1}{2}$ times the length of the second; second joint a little longer than the third; third joint $\frac{1}{4}$ longer than the fourth and slightly longer than the fifth joint. Wings almost hyaline, with a more or less brilliant aurichalceous reflection when viewed at a certain obliquity. Veins yellowish-brown, the third and fourth longitudinal pale. First longitudinal vein joining the costa considerably before the base of the fork, and somewhat before the tip of the posterior branch of the fourth longitudinal; cross-vein pale; petiole scarcely visible, longer than the anterior branch of the fork; branches little arcuated, particularly the anterior one making the fork rather angular at the base; tips distinctly divergent. *fg* exactly the same length as *gh*; *kl* a little shorter than *lm*.

♀.—Antennæ very slender, almost half the length of the body, with a very short dense pubescence; flagellar joints one-half longer than broad; terminal joints twice as long as broad. Head, thorax and abdomen deep brown; lamellæ of the ovipositor small,

oval. Petiole scarcely paler than the fork, shorter than the anterior branch, about the same length as the posterior branch. *fg* nearly twice the length of *gh*.

Hab.—Glenbrook, Blue Mountains (Masters). November.

122. *SCIARA ATRATULA*, sp.n.

♀.—Length of antennæ.....	0·020 inch	...	0·50 millimètre.
Expanse of wings.....	0·050 × 0·020	...	1·27 × 0·50
Size of body.....	0·045 × 0·010	...	1·13 × 0·25

Antennæ slender, as long as the head and thorax together; black, with a dense brown pubescence; joints of the scapus brown, with apparently no pubescence; flagellar joints sub-sessile, rather longer than broad towards the tip, the terminal joint about twice as long as broad. Head black. Eyes almost contiguous above. Palpi black or deep brown. Thorax black, levigate, with three very indistinct longitudinal double rows of very short brownish hairs, the intermediate one particularly indistinct, apparently only extending to the middle of the thorax, the lateral ones wider, running almost to the scutellum; a few long brownish hairs anterior to the origin of the wings; apparently no pubescence on the scutellum. Halteres black, the base of the stem sordid ochraceous; club very little thickened; apparently no pubescence. Abdomen rather wider than the thorax, deep olive-brown, darker between the segments, clothed with a very short dense pubescence; lamellæ of the ovipositor very small, elongate. Coxæ and femora fuliginous-ochraceous. Tibiæ and tarsi almost fuliginous. In the fore-legs the tarsi nearly $\frac{1}{6}$ longer than the tibiæ; in the intermediate- and hind-legs the tibiæ and tarsi of equal length. Spurs very small. First joint of the tarsi twice the length of the second; second joint about $\frac{1}{4}$ longer than the third; third and fifth joints of equal length, about $\frac{1}{4}$ longer than the fourth. Wings pellucid, with an almost fuliginous tint; cupreous and violaceous reflections. Costal and two first longitudinal veins fuliginous. First longitudinal vein reaching the costa considerably

before the base of the fork and somewhat before the tip of the posterior branch of the fourth longitudinal; petiole paler than the fork, longer than the anterior branch; branches, particularly the posterior one, little arcuated, making the fork rather angular at the base; tips non-divergent. *fg* a little more than 3 times the length of *gh*; *kl* somewhat shorter than *lm*.

Hab.—Elizabeth Bay (Skuse). May.

2. Palpi yellow.

B. Cross-vein situated at the middle of the first longitudinal vein.

b. *Tip of the second longitudinal vein and tip of the posterior branch of the fork equally near the apex of the wing.*

123. SCIARA LUCULENTA, sp.n.

♀.—Length of antennæ.....	0·085 inch	...	2·14 millimètres.
Expanse of wings.....	0·120 × 0·045	...	3·04 × 1·13
Size of body.....	0·120 × 0·020	...	3·04 × 0·50

Antennæ slender, more than two-thirds the length of the body, black, with a short dense pubescence; joints of the scapus light pitch-brown, with a few golden-yellow hairs longer than the pubescence of the flagellar joints; flagellar joints sub-sessile, $2\frac{1}{3}$ to 4 times as long as broad, the terminal joint rather longer than the preceding. Head black, with a greenish reflection. Eyes contiguous above. Palpi pale yellow. Thorax ferruginous-ochraceous, levigate, with three longitudinal double rows of short golden-yellow hairs, the lateral ones also with a row of moderately long black hairs; intermediate row reaching almost as far as the lateral ones, which extend nearly to the scutellum; a few long black hairs, with some short golden yellow hairs, between the origin of the wings and the humeri; scutellum with a few very long black hairs interspersed with a sparse short golden-yellow pubescence. Halteres pale brown with a few short hairs, stem honey-yellow. Abdomen deep brown,

almost fuliginous on the dorsal segments, between the segments and underneath sordid ochraceous; short moderately dense pubescence; ovipositor long, ochraceous-brown, the lamellæ small, oval. Coxæ and femora pale yellow, the former with rather long brownish hairs in the upper side. Tibiæ and tarsi cinereous. In the fore- and intermediate-legs the tarsi a little longer than the tibiæ; in the hind-legs the tibiæ and tarsi of about equal length. Spurs long, equal in length to the third tarsal joint. First joint of the tarsi about 3 times the length of the second; second joint $\frac{1}{2}$ longer than the third and equal to the fourth and fifth together; fourth joint same length as the fifth. Wings pellucid, with a pale yellowish-brown tint; opaline reflections. Veins yellowish-brown. Fork of the third longitudinal vein and apical portion of the petiole fringed with short brown hairs. First longitudinal vein reaching the costa a little before the base of the fork, and considerably beyond the tip of the posterior branch of the fourth longitudinal; petiole much paler than the fork, as long as the anterior branch; branches running almost parallel to one another, scarcely divergent at the tips; posterior branch a little arcuated at the base; fourth longitudinal vein more distinct than the last. *fg* nearly twice the length of *gh*; *hl* slightly longer than *lm*.

Hab.—Middle Harbour, near Sydney (Froggatt and Skuse). April.

c. *Tip of the posterior branch of the fork nearer the apex of the wing than the tip of the second longitudinal vein.*

124. *SCIARA FUMIPENNIS*, sp.n.

♀.—Length of antennæ.....	0·050 inch	...	1·27 millimètres.
Expanse of wings.....	0·090 × 0·040	...	2·27 × 1·01
Size of body.....	0·085 × 0·015	...	2·14 × 0·38

Antennæ slender, more than half the length of the body, deep brown, with a dense pale brownish pubescence; joints of the scapus deep brown, sparsely haired; flagellar joints sub-sessile, $2\frac{1}{2}$ to 3 times as long as wide, the terminal joint longer. Head

black. Eyes contiguous above. Palpi yellow. Thorax reddish-brown, levigate, with three rather indistinct longitudinal double rows of very short brownish hairs extending nearly to the scutellum, not coalescent; also a few short hairs between the origin of the wings and the humeri; scutellum with some short brownish hairs and a few long brown setæ. Halteres light reddish-brown, with a few very short hairs, the base of the stem yellowish. Abdomen umber-brown on the dorsal segments, pale between the segments and underneath, rather densely clothed with a moderately long pubescence; lamellæ of the ovipositor small, elongate. Coxæ honey-yellow, the femora more ochraceous; tibiæ and base of the metatarsal joint dusky pitch-brown, the remainder black. In the fore-legs the tarsi nearly $\frac{1}{2}$ longer than the tibiæ; in the intermediate-legs the tibiæ and tarsi of about equal length; in the hind-legs the tibiæ a little longer than the tarsi. Spurs about the length of the third tarsal joint. First joint of the tarsi in the fore- and intermediate-legs rather more than twice the length of the second, in the hind-legs $2\frac{1}{2}$ times the length; second joint $\frac{1}{4}$ longer than the third and somewhat longer than the fourth and fifth together; third joint about $\frac{1}{3}$ longer than the fourth; fourth and fifth joints of almost equal length. Wings pellucid, very pale smoky brown, with dusky brown veins; brilliant margaritaceous reflections. First longitudinal vein reaching the costa a short distance before the base of the fork; cross-vein distinct; petiole very pale, shorter than the anterior branch of the fork; both branches fringed with very short, stiff, brown hairs, running almost parallel to one another for the greater part of their length, and slightly divergent at the tips; the posterior branch almost as much arcuated at the base as the anterior one. *fg* rather more than twice the length of *gh*; *kl* equal to *lm*.

Hab.—Woronora (Masters and Skuse). October.

C. Cross-vein situated beyond the middle of the first longitudinal vein.

a. *Tip of the second longitudinal vein nearer the apex of the wing than the tip of the posterior branch of the fork.*

125. *SCIARA UNICA*, sp.n.

♂.—Length of antennæ.....	0·060 inch	...	1·54 millimètres.
Expanse of wings.....	0·095 × 0·040	...	2·39 × 1·01
Size of body.....	0·085 × 0·012	...	2·14 × 0·30

Antennæ slender, about three-fourths the length of the body, black with a dense pale pubescence; joints of the scapus black, very sparsely haired; flagellar joints sub-sessile (minute pedicels perceptible towards the tip) 2 to 3 times as long as broad, the terminal joint longer and more slender. Head black, levigate. Eyes contiguous above. Palpi yellowish. Thorax black, levigate, with three longitudinal single rows of very short golden-yellow hairs, running nearly parallel to one another; also a few scattered short golden-yellow hairs on the lateral margins before the origin of the wings, and on the scutellum. Halteres cinereous, the base of the stem ochraceous; club sparsely covered with very short hairs. Abdomen slender, black, sparingly clothed with some moderately long pale hairs; forceps rather elongate, not so wide as the terminal abdominal segment. Coxæ and femora ochraceous; tibiæ and first joint of the tarsi ochraceous-brown, the remaining joints black. In all the legs the tarsi a little longer than the tibiæ, about $\frac{1}{4}$ longer in the fore-legs. Spurs pale yellow, shorter than the fourth tarsal joint. First joint of the tarsi nearly $2\frac{1}{2}$ times the length of the second; second joint $\frac{1}{3}$ longer than the third, and as long as the fourth and fifth together; third joint $\frac{1}{2}$ longer than the fourth; fifth joint a little longer than the fourth. Wings pellucid, with a somewhat fuliginous tint, costal and two first longitudinal veins fuliginous; margaritaceous reflections. First longitudinal vein reaching the costa a short distance before the base of the fork, and opposite the tip of the posterior branch of the fourth longitudinal; petiole very indistinct, shorter than the posterior branch of the fork; branches almost equally arcuated at the base, running nearly parallel for the greater part of their length, divergent at the tips; tip of the second longitudinal

vein somewhat nearer the apex of the wing than the tip of the posterior branch. *fg* twice the length of *gh*; *kl* almost as long as *lm*.

Hab.—Gosford (Skuse). February.

b. *Tip of the second longitudinal vein and tip of the posterior branch of the fork equally near the apex of the wing.*

126. *SCIARA WINNERTZI*, sp.n.

♂.—Length of antennæ.....	0·110 inch	...	2·79 millimètres.
Expanse of wings.....	0·100 × 0·040	...	2·54 × 1·01
Size of body.....	0·110 × 0·015	...	2·79 × 0·38

Antennæ slender, black, with a dense pale pubescence; joints of the scapus obscure pitch-brown, with very few hairs; flagellar joints sub-sessile, three to five times as long as broad, the terminal joint considerably longer; pedicels very short. Head black. Eyes contiguous above. Palpi honey-yellow. Thorax obscure pitch-brown, levigate with three longitudinal double rows of pale brownish hairs, the intermediate one running about two-thirds of the distance to the scutellum, the lateral ones a little convergent, reaching almost to the scutellum; also some setaceous hairs between the origin of the wings and the humeri; humeri tipped with ochraceous-brown; scutellum pitch-brown, with a few setaceous hairs. Halteres light pitch-brown, with a few short hairs, the stalk honey-yellow. Abdomen slender, dorsal segments deep brown, between the segments and underneath honey-yellow; densely clothed with a moderately long pale brownish pubescence; forceps pitch-brown, wider than the last two segments, densely pubescent. Coxæ and femora honey-yellow, the former with a somewhat reddish tinge, and long hairs on the front. Tibiæ pitch-brown. Tarsi almost black, on account of their dense pubescence; the metatarsal joint brownish at the base. In the fore-legs the tarsi somewhat longer than the tibiæ; in the intermediate-legs the tibiæ and tarsi of about equal

length; in the hind-legs the tibiæ somewhat longer than the tarsi. Spurs almost as long as the third tarsal joint. First joint of the tarsi about 3 times the length of the second; second joint $\frac{1}{4}$ longer than the third and almost as long the third and fourth together; third joint $\frac{1}{3}$ longer than the fourth and almost twice the length of the fifth. Wings pellucid, with a very pale brownish-yellow tint; veins pale brown; brilliant margaritaceous reflections when viewed at a certain obliquity. First longitudinal vein reaching the costa a short distance before the base of the fork, and opposite to the tip of the posterior branch of the fourth longitudinal vein; cross-vein short and indistinct, just beyond the middle of the first longitudinal vein; petiole very pale and indistinct, not quite as long as the anterior branch of the fork; branches running parallel for the greater part of their length and slightly divergent at the tips; posterior branch very little arcuated at the base. *fg* about twice the length of *gh*; *kl* a little shorter than *lm*.

Hab.—Glenbrook (Masters). November.

127. SCIARA MONTIVAGA.

♂.—Length of antennæ.....	0·070 inch	...	1·77 millimètres.
Expanse of wings.....	0·090 × 0·035	...	2·27 × 0·88
Size of body.....	0·080 × 0·012	...	2·02 × 0·30

Antennæ slender, not quite the length of the body, deep brown, with a dense pale yellowish pubescence; joints of the scapus deep brown, with very little pubescence; flagellar joints sub-sessile, 2 to $4\frac{1}{2}$ times as long as broad, the terminal joint longer. Head black. Eyes contiguous above. Palpi yellow. Thorax black, levigate, with three longitudinal double rows of short brownish-yellow hairs, the intermediate row extending almost as far as the lateral ones, these latter almost reaching the scutellum; also some similar hairs along the lateral margins and on the scutellum, interspersed with a few long brown setæ. Halteres light brown, the base of the stalk yellowish, sparsely covered with very short hairs.

Abdomen about as wide as the thorax, black or very deep brown on the dorsal segments, pale underneath, densely clothed with a short pubescence; forceps not so wide as the thorax, densely pubescent. Coxæ and femora honey-yellow, tibiæ and tarsi pale pitch-brown. In the fore-legs the tarsi $\frac{1}{4}$ longer than the tibiæ; in the intermediate-legs the tarsi somewhat longer than the tibiæ; in the hind-legs the tibiæ a little longer than the tarsi. Spurs honey-yellow, about as long as the fourth tarsal joint. First joint of the tarsi twice the length of the second; second joint $\frac{1}{4}$ longer than the third and longer than the fourth and fifth together; third joint $\frac{1}{3}$ longer than the fourth; fourth joint rather longer than the fifth. Wings hyaline, the costal and two first longitudinal veins brown, the rest very pale; brilliant yellow-green and roseous reflections. First longitudinal vein reaching the costa a short distance before the base of the fork; cross-vein rather pale; petiole almost invisible, longer than the anterior branch of the fork; both branches very indistinct at the base, running almost parallel for the greater part of their length, a little divergent at the tips; the posterior branch only very slightly arcuated at the base. *fg* twice the length of *gh*; *kl* rather shorter than *lm*.

Hab.—Glenbrook (Masters); Berowra and Knapsack Gully (Masters and Skuse). August to November.

128. SCIARA ORNATULA, sp.n.

♂.—Length of antennæ.....	0.055 inch	...	1.89 millimètres.
Expanse of wings.....	0.065 × 0.025	...	1.66 × 0.62
Size of body	0.065 × 0.010	...	1.66 × 0.25

Antennæ slender, not quite the length of the body, deep brown, with a dense pale yellowish pubescence; joints of the scapus deep brown, very sparsely pubescent; flagellar joints $2\frac{1}{2}$ to $4\frac{1}{2}$ times as long as broad, with very short pale pedicels, the terminal joints very slender. Head black. Eyes contiguous above. Palpi yellow. Thorax light ferruginous-brown, levigate, with three

longitudinal double rows of very short brownish-yellow hairs, the intermediate row extending a little beyond the middle of the thorax, the lateral ones not quite reaching the scutellum; a very few long setæ on the lateral margins above the origin of the wings, also two long setæ on the scutellum, with a sparse sprinkling of short brownish-yellow hairs. Halteres obscure umber-brown, the root of the stem yellowish, club sparsely covered with very short hairs. Abdomen dusky umber-brown, whitish between the segments, somewhat sparsely clothed with a short pubescence; forceps light ferruginous-brown, rather small, considerably narrower than the abdomen, densely covered with a minute pubescence. Coxæ and femora honey-yellow, the tibiæ and tarsi darker on account of their minute dense pubescence. In the fore-legs the tarsi about $\frac{1}{5}$ longer than the tibiæ; in the intermediate-legs the tarsi somewhat longer than the tibiæ; and in the hind-legs the tibiæ a very little longer than the tarsi. Spurs honey-yellow, shorter than the fourth tarsal joint. First joint of the tarsi in the two first pairs of legs about twice the length of the second, in the hind-legs rather more than twice its length; second joint about $\frac{1}{5}$ longer than the third and equal in length to the fourth and fifth together; third joint about $\frac{1}{3}$ longer than the fourth; fourth and fifth joints of equal length. Wings hyaline, the costal and two first longitudinal veins brownish-yellow, the rest pale; purpureous reflections. First longitudinal vein reaching the costa some distance before the base of the fork; cross-vein rather pale; petiole a little paler than the fork, longer than the anterior branch; branches running almost parallel for the greater part of their length, tips a little divergent. *fy* about $3\frac{1}{2}$ times the length of *gh*; *kl* shorter than *lm*.

Hab.—Sydney (Skuse). September.

129. SCIARA AMABILIS, sp.n.

♂.—Length of antennæ.....	0·045 inch	...	1·13 millimètres.
Expanse of wings.....	0·085 × 0·035	...	2·14 × 0·88
Size of body.....	0·080 × 0·012	...	2·02 × 0·30

Antennæ slender, rather more than half the length of the body, black, densely covered with a very short pale pubescence; joints of the scapus black, sparsely haired; flagellar joints sub-sessile, 2 to 3 times as long as broad, becoming very slender towards the tip. Head black. Eyes contiguous above. Palpi yellow. Thorax black, sub-nitidous, with three longitudinal double rows of short yellowish-brown hairs, the intermediate row extending for about three-fourths of the distance to the scutellum, the lateral ones almost reaching the scutellum, not coalescent; some short yellowish-brown hairs, interspersed with long brown setæ, on the lateral margins between the origin of the wings and the humeri, and on the scutellum. Halteres dusky-brown, with a sprinkling of very short hairs, the base of the stem brownish-ochraceous. Abdomen as wide as the thorax, deep brown, appearing almost black, densely clothed with a moderately long brownish pubescence; forceps deep brown, broader than the terminal abdominal segment. Coxæ ferruginous-ochraceous; femora, tibiæ and tarsi dusky pitch-brown, the last three joints of the tarsi nearly black. In the fore-legs the tarsi nearly $\frac{1}{4}$ longer than the tibiæ; in the intermediate-legs the tarsi about $\frac{1}{3}$ longer than the tibiæ; in the hind-legs the tibiæ and tarsi of equal length. Spurs shorter than the last tarsal joint. First joint of the tarsi twice the length of the second; second joint $\frac{1}{4}$ longer than the third and equal to the fourth and fifth together; third joint about $\frac{1}{2}$ longer than the fourth; fourth joint somewhat longer than the fifth. Wings almost hyaline, but having a faint greyish tint, the costal and two first longitudinal veins brown, the rest of the veins greyish; violaceous and purpureous reflections. First longitudinal vein reaching the costa a short distance before the base of the fork; cross-vein somewhat indistinct; petiole hardly visible, a very little longer than the anterior branch of the fork; both branches distinct, the posterior branch less arcuated at the base than the anterior one, running almost parallel to one another for the greater part of their length, the tips considerably divergent; fourth longitudinal vein distinct. *fg* about $\frac{1}{2}$ longer than *gh*; *kl* somewhat shorter than *lm*.

Hab.—Sydney (Masters and Skuse). September.

130. *SCIARA LUCIDIPENNIS*, sp.n.

♀.—Length of antennæ.....	0·030 inch	...	0·76 millimètre.
Expanse of wings.....	0·070 × 0·025	...	1·77 × 0·62
Size of body.....	0·070 × 0·015	...	1·77 × 0·38

Antennæ deep brown, with a minute pale pubescence; slender, not half the length of the body; joints of the scapus rather paler brown than those of the flagellum, with very little pubescence; flagellar joints sub-sessile, 2 to $2\frac{1}{2}$ times as long as broad, densely haired. Head black, levigate. Eyes contiguous above. Palpi yellow. Thorax obscure reddish-black, with three longitudinal double rows of minute yellowish-brown hairs from the collare to the scutellum, also a few long hairs on the lateral margins between the origin of the wings and the humeri, and on the scutellum; pleuræ obscure reddish-brown. Halteres obscure olivaceous, with a few very minute hairs on the apex, stem yellow. Abdomen broader than the thorax, olivaceous, paler between the segment and on the underside, rather sparsely clothed with a minute pubescence; lamellæ of the ovipositor minute, elliptical, rather densely pubescent. Legs greyish-ochraceous, the front of the femora, and the tibiæ and tarsi considerably darker than the rest. Coxæ with tolerably long hairs on the front. Femora, tibiæ and tarsi with a minute pubescence, much less dense on the femora. In the fore- and intermediate-legs the tarsi a little longer than the tibiæ; in the hind-legs the tibiæ and tarsi of about equal length. First joint of the tarsi shorter than the four following combined, and $2\frac{1}{4}$ times the length of the second; second joint about $\frac{1}{5}$ longer than the third and shorter than the fourth and fifth together; fourth joint somewhat shorter than the fifth. Wings almost hyaline, with a very pale brownish tint; the costal and two first longitudinal veins obscure yellowish-brown; tip and posterior margin with brilliant cupreous reflections, the anterior portion violaceous and bright æneous. First longitudinal vein reaching the costa considerably before the base of the fork and opposite to the tip of the posterior branch of the fourth

longitudinal vein; petiole paler than the fork, and longer than the anterior branch; posterior branch very little arcuated at the base; anterior branch more divergent at the tip than the posterior branch. *fg* about $2\frac{1}{4}$ times the length of *gh*; *kl* shorter than *lm*.

Hab.—Elizabeth Bay (Skuse). April.

c. *Tip of the posterior branch of the fork nearer the apex of the wing than the tip of the second longitudinal vein.*

131. SCIARA NUBICULA, sp.n.

♀.—Length of antennæ.....	0.060 inch	...	1.54 millimètres.
Expanse of wings.	0.095 × 0.035	..	2.39 × 0.88
Size of body.....	0.090 × 0.015	...	2.27 × 0.38

Antennæ very slender, two-thirds the length of the body, deep brown, densely pubescent; joints of the scapus pitch-brown, sparingly haired; flagellar joints sub-sessile, 3 to $3\frac{1}{2}$ times as long as broad. Head black. Eyes contiguous above. Palpi yellow. Thorax deep brown, sub-nitidous, with three longitudinal single rows of brown hairs, double just before the collare, also a few very long setæ just before the origin of the wings and on the scutellum. Halteres dusky brown, with a very short sparse pubescence, the base of the stem yellowish. Abdomen umber-brown on the dorsal segments, whitish between the segments and underneath, densely clothed with a short brown pubescence; lamellæ of the ovipositor very small, oval. Coxæ and femora ochraceous; tibiæ and tarsi ochraceous-brown, the last joints of the tarsi dusky. In the fore-legs the tarsi nearly $\frac{1}{4}$ longer than the tibiæ; in the intermediate-legs the tarsi about $\frac{1}{5}$ longer than the tibiæ; in the hind-legs of equal length. Spurs honey-yellow, about the length of the fourth tarsal joint. First joint of the tarsi in the fore- and intermediate-legs twice the length of the second, in the hind-legs $2\frac{1}{3}$ times the length; second joint $\frac{1}{5}$ longer than the third and equal to the fourth and fifth together; third joint $\frac{1}{4}$ longer than the fourth; fourth joint about

$\frac{1}{5}$ longer than the fifth. Wings pellucid with a greyish tint, the costal and two first longitudinal veins umber-brown; brilliant opaline reflections. First longitudinal vein reaching the costa a short distance before the base of the fork; cross-vein distinct; third longitudinal vein very pale; petiole scarcely visible, longer than the anterior branch; fork narrow, the branches almost equally arcuated at the base, running parallel to one another for the greater part of their length, a little divergent at the tips. *fg* twice the length of *gh*; *kl* somewhat shorter than *lm*.

Hab.—Middle Harbour (Froggatt and Skuse). April.

132. SCIARA SPECTABILIS, sp.n.

♂.—Length of antennæ... ..	0·070 inch	...	1·77 millimètres.
Expanse of wings... ..	0·080 × 0·030	...	2·02 × 0·76
Size of body.....	0·080 × 0·012	...	2·02 × 0·30
♀.—Length of antennæ.....	0·045 inch	...	1·13 millimètres.
Expanse of wings.....	0·095 × 0·040	...	2·39 × 1·01
Size of body.....	0·095 × 0·015	...	2·39 × 0·38

Antennæ slender, nearly the length of the body, deep brown, with a dense brownish-yellow pubescence; joints of the scapus sparingly haired, the first joint ochraceous, the second deep brown; flagellar joints sub-sessile, $2\frac{1}{2}$ to 4 times as long as broad, the terminal joints very slender. Head black. Eyes contiguous above. Palpi yellow. Thorax pitch-brown, levigate, with three darker narrow longitudinal stripes, each with a single row of deep brown hairs, the intermediate one stopping a short distance from the scutellum, the lateral ones not coalescent, reaching the scutellum; the lateral margins and scutellum setose. Halteres dusky-brown, the base of the stem yellow, club sparingly covered with a short pubescence. Abdomen brown on the dorsal segments, whitish underneath and between the segments; densely pubescent; forceps brown, a little wider than the terminal segment. Coxæ and femora honey-yellow; tibiæ and tarsi almost cinereous. In the fore-legs the tarsi $\frac{1}{3}$ longer than the tibiæ; in the intermediate-legs

the tarsi almost imperceptibly longer than the tibiæ; in the hind-legs the tibiæ nearly $\frac{1}{2}$ longer than the tarsi. Spurs honey-yellow, as long as the last tarsal-joint. First joint of the tarsi about 3 times the length of the second; second joint $\frac{1}{6}$ longer than the third; third joint $\frac{1}{3}$ longer than the fourth; fifth joint somewhat longer than the fourth. Wings pellucid, with a pale yellowish tint, the costal and two first longitudinal veins yellowish-brown; brilliant margaritaceous reflections. First longitudinal vein reaching the costa some distance before the base of the fork and somewhat before the tip of the posterior branch of the fourth longitudinal; petiole almost invisible, considerably longer than either branch of the fork; branches running almost parallel for the greater part of their length, slightly divergent at the tips, the posterior branch very little arcuated at the base; the petiole just before the fork and both branches ciliate, in some specimens more so than in others. *fg* rather more than $2\frac{1}{2}$ times the length of *gh*; *kl* somewhat shorter than *lm*.

♀.—Antennæ a little longer than the head and thorax together; joints of the scapus ochraceous; flagellar joints 2 to 3 times as long as broad. Thorax brown-ochraceous, with no darker stripes but two distinct rows of deep brown hairs, and a very indistinct intermediate one, extending a little beyond the middle of the thorax. Abdomen of a lighter brown on the dorsal segments than in the ♂; ovipositor pale brown, the lamellæ small, elongate. Tibial spurs longer than the fourth and fifth tarsal joints. Petiole almost invisible, about equal in length to the anterior branch of the fork. Cross-vein not so much beyond the middle of the first longitudinal vein as in the ♂. *fg* three times the length of *gh*; *kl* almost as long as *lm*.

Hab.—Sydney and Berowra (Masters and Skuse). November to January.

133. SCIARA IGNOBILIS, sp.n.

♂.—Length of antennæ.....	0·045 inch	...	1·13 millimètres.
Expanse of wings.....	0·070 × 0·030	...	1·77 × 0·76
Size of body.....	0·065 × 0·012	...	1·66 × 0·30

Antennæ slender, nearly three-fourths the length of the body, black, with a dense short yellowish pubescence; joints of the scapus black, very sparsely haired; flagellar joints visibly pedicelled, the pedicels $\frac{1}{3}$ the length of the joints; joints twice as long as broad, the terminal one a little longer. Head black. Eyes contiguous above. Palpi yellowish. Thorax black, levigate, with three longitudinal double rows of yellowish hairs, the intermediate row scarcely perceptible, apparently terminating before the middle of the thorax, and the lateral ones extending nearly to the scutellum, the hairs sparse, long; also some long yellowish setæ on the lateral borders, and on the scutellum. Halteres dusky brown, with a few short hairs, the stem yellowish. Abdomen as broad as the thorax, obscure olivaceous, pale between the segments and underneath; rather sparsely haired; forceps rather wider than the terminal segment, densely pubescent. Coxæ and femora yellowish-brown; tibiæ and tarsi dusky brown, the last four tarsal joints black. In the fore-legs the tarsi longer than the tibiæ by the last joint; in the intermediate-legs the tibiæ and tarsi almost of equal length, the tibiæ being somewhat longer; in the hind-legs the tibiæ a very little longer than the tarsi. Spurs shorter than the fourth tarsal joint. First joint of the tarsi $2\frac{1}{2}$ times the length of the second; second joint $\frac{1}{3}$ longer than the third; third joint about $\frac{1}{4}$ longer than the fourth and somewhat longer than the fifth. Wings almost hyaline, but having a yellowish tint, the costal and first two longitudinal veins umber-brown; rather weak opaline reflections. First longitudinal vein reaching the costa some distance before the base of the fork; cross-vein somewhat indistinct; petiole much paler than the fork and shorter than the anterior branch; branches almost imperceptibly divergent for the whole of their length, not at the tips; the posterior branch very little arcuated at the base; branches of the fourth longitudinal vein more distinct than the last. *fg* nearly twice *gh*; *kl* somewhat longer than *lm*.

Hab.—Berowra (Masters and Skuse). August.

134. *SCIARA INFREQUENS*, sp.n.

♂.—Length of antennæ.....	0.040 inch	...	1.01 millimètres.
Expanse of wings.....	0.060 × 0.025	...	1.54 × 0.62
Size of body.....	0.055 × 0.010	...	1.39 × 0.25

Antennæ slender, rather more than two-thirds the length of the body, brown, with a dense brownish-yellow pubescence; joints of the scapus with scarcely any pubescence; flagellar joints sessile, 3 to 4 times as long as broad, the joints very slender towards the tip. Head black. Eyes contiguous above. Palpi yellow. Thorax reddish-brown, levigate, with three longitudinal single rows of brownish hairs from the collare to the scutellum, not coalescent posteriorly; also a few brown setæ between the origin of the wings and the humeri and on the scutellum. Halteres dusky-brown, sprinkled with a few very short hairs, the stem yellowish at the base. Abdomen slender, black or very deep brown on the dorsal segments, pale between the segments and underneath, densely clothed with a moderately long pubescence; forceps somewhat elongate, narrower than the terminal segment, ochraceous-brown, densely pubescent. Coxæ and femora honey-yellow; tibiæ and tarsi ochraceous. In the fore-legs the tarsi somewhat longer than the tibiæ; in the intermediate-legs the tibiæ somewhat longer than the tarsi; in the hind-legs the tibiæ $\frac{1}{2}$ longer than the tarsi. Spurs as long as the fourth tarsal joint. First joint of the tarsi about $2\frac{1}{2}$ times the length of the second; second joint $\frac{1}{4}$ longer than the third, and equal to the fourth and fifth together; third joint almost $\frac{1}{2}$ longer than the fourth; fourth joint somewhat shorter than the fifth. Wings hyaline, the costal and two first longitudinal veins umber-brown; smaragdine and golden reflections. First longitudinal vein reaching the costa considerably before the base of the fork; cross-vein rather indistinct; petiole almost invisible, somewhat longer than the anterior branch of the fork; branches moderately arcuated at the base, the posterior less than the anterior, running almost

parallel to one another for the greater part of their length, slightly divergent at the tips. *fg* nearly 3 times the length of *gh*; *kl* somewhat shorter than *lm*.

Hab.—Elizabeth Bay (Skuse). January.

B. Halteres yellow or whitish.

1. Palpi black or brown.

B. Cross-vein situated at the middle of the first longitudinal vein.

c. Tip of the posterior branch of the fork nearer the apex of the wing than the tip of the second longitudinal vein.

135. *SCIARA NOTATA*, sp.n.

♂.—Length of antennæ.....	0.095 inch	...	2.39 millimètres,
Expanse of wings.....	0.105 × 0.040	...	2.67 × 1.01
Size of body	0.100 × 0.017	...	2.54 × 0.42

Antennæ slender, almost the length of the body, black, with a short, dense brownish pubescence; first joint of the scapus black, second pitch-brown, sparsely haired; flagellar joints with very minute pedicels, the joints 3 to 6 times as long as broad, those towards the tip being very slender. Head black. Eyes contiguous above. Palpi brown. Thorax black, levigate, with three longitudinal rows of golden yellow hairs, the intermediate row single, not very distinct, extending a little beyond the middle of the thorax, the lateral ones double, the hairs much longer than those of the intermediate row, and very long just before the scutellum; also some golden-yellow pubescence and brown setæ on the lateral borders and on the scutellum. Halteres honey-yellow. Abdomen not so wide as the thorax, black in the dorsal segments, deep brown underneath, densely pubescent; forceps short, robust, rather wider than the terminal segment. Coxæ and femora bright pitch-brown; tibiæ and tarsi dusky brown, the tips of the tarsi fuliginous. In the fore-legs the tarsi about $\frac{1}{3}$ longer than the

tibiæ; in the intermediate-legs the tarsi a very little longer than the tibiæ; in the hind-leg the tibiæ and tarsi very long, of equal length. Spurs as long as the fourth tarsal joint. First tarsal joint in the fore- and intermediate-legs about twice the length of the second, in the hind-legs $2\frac{2}{3}$ times the length; second joint about $\frac{1}{5}$ longer than the third, and rather longer than the fourth and fifth joints together; third joint about $\frac{1}{3}$ longer than the fourth; fourth joint a little longer than the fifth. Wings pellucid with a pale smoky tint, the costal and two longitudinal veins umber-brown; pale opaline reflections. First longitudinal vein reaching the costa a short distance before the base of the fork; cross-vein somewhat indistinct; petiole very pale, about as long as the anterior branch of the fork; branches running almost parallel to one another, a little divergent at the tips; the posterior branch very little arcuated at the base, its tip very little nearer the apex of the wing than the tip of the second longitudinal vein; fourth longitudinal vein with its branches well-defined. *fg* about $2\frac{1}{3}$ times the length of *gh*; *kl* a little shorter than *lm*.

Hab.—Glenbrook, Blue Mountains (Masters). November.

2. Palpi yellow.

C. Cross-vein situated beyond the middle of the first longitudinal vein.

b. *Tip of the second longitudinal vein and tip of the posterior branch of the fork equally near the apex of the wing.*

136. SCIARA PICTIPES, sp.n.

♂.—Length of antennæ.....	0.075 inch	... 1.89 millimètres.
Expanse of wings.....	0.090×0.035	... 2.27×0.88
Size of body.....	0.080×0.015	... 2.02×0.38

Antennæ slender, particularly towards the tip, nearly the length of the body, black, with a very dense greyish-brown pubescence;

joints of the scapus very sparsely haired; flagellar joints sessile, $2\frac{1}{2}$ to 4 times as long as broad, the terminal joint considerably longer. Head black. Eyes contiguous above. Palpi yellow. Thorax black, levigate, with three longitudinal double rows of minute yellowish pubescence, the intermediate row indistinct, reaching a little beyond the middle of the thorax, the lateral ones very distinct, extending almost to the scutellum, not coalescent; some short yellowish pubescence and long setæ between the origin of the wings and the humeri, also on the scutellum. Halteres pale yellow, with very little visible pubescence. Abdomen nearly as wide as the thorax, uniformly black, moderately clothed with a short yellowish pubescence; forceps short and robust, as wide as the terminal abdominal segment. Coxæ and femora ochraceous; tibiæ and tarsi brownish-ochraceous, the tips of the tarsi dusky. In the fore-legs the tarsi nearly $\frac{1}{4}$ longer than the tibiæ; in the intermediate-legs the tarsi somewhat longer than the tibiæ; in the hind-legs the tibiæ about $\frac{1}{10}$ longer than the tarsi. Spurs as long as the last tarsal joint. First joint of the tarsi in the fore- and intermediate-legs about twice the length of the second, in the hind-legs $2\frac{2}{3}$ times the length; second joint about $\frac{1}{6}$ longer than the third and somewhat longer than the fourth and fifth together; third joint $\frac{1}{3}$ longer than the fourth; fourth joint $\frac{1}{4}$ longer than the fifth. Wings pellucid, with a very pale smoky appearance, the costal and two first longitudinal veins deep brown; bright margaritaceous reflections. First longitudinal vein reaching the costa a short distance before the base of the fork; cross-vein distinct, situated a little beyond the middle of the first longitudinal; petiole very pale, shorter than the anterior branch of the fork; branches running almost parallel to one another for the greater part of their length, divergent at the tips; the posterior branch very little arcuated at the base. *fg* nearly twice the length of *gh*; *kl* somewhat shorter than *lm*.

Hab.—In the neighbourhood of Narrabeen Lagoon (Skuse). October.

Genus 2. TRICHOSIA, Winnertz.

Trichosia, Winnertz, Beitr. z. Mon. d. Sciarinen, 1867.

Characters the same as in *Sciara*, with the difference that the surface of the wings is distinctly hairy.

Only a very few species of this distinct genus have yet been described, but they come from widely different parts of the world, so that this genus is no doubt represented in most countries. The following is the first described from Australia; others have been recorded from Europe and North America:—

137. TRICHOSIA MASTERSI, sp.n.

♂.—Length of antennæ.....	0·088 inch	...	2·14 millimètres.
Expanse of wings.....	0·090 × 0·035	...	2·27 × 0·88
Size of body.....	0·085 × 0·020	...	2·14 × 0·50
♀.—Length of antennæ.....	0·047 inch	...	1·23 millimètres.
Expanse of wings.....	0·100 × 0·040	...	2·54 × 1·01
Size of body.....	0·110 × 0·030	...	2·79 × 0·76

♂.—Antennæ pitch-brown, with a minute yellowish pubescence; slender, the length of the body; basal joints deep brown, sparsely pubescent; flagellar joints sub-sessile, $2\frac{1}{2}$ to 3 times as long as broad. Head black. Eyes contiguous above. Palpi black or deep brown. Thorax black, levigate, with three longitudinal double rows of yellowish hairs, the intermediate one indistinct; setaceous hairs on the lateral margins and scutellum. Halteres almost naked, smoky-yellow, with the base of the stem a brighter yellow; club large, pyriform. Abdomen black, with a pale pubescence, narrower than the thorax, almost cylindrical, gradually dilated towards the middle; forceps black, densely covered with a minute pubescence, considerably broader than the terminal segment of the abdomen. Legs yellowish-brown, the under-sides of all the femora considerably brighter than the other portions of the legs; tarsal joints almost pitch-brown on account of their minute dense pubescence. Fore femora shorter

than the intermediate ones, and the latter shorter than the hind femora. In the fore-legs the tarsi longer than the tibiae; in the intermediate-legs both of about equal length; in the hind-legs the tibiae somewhat longer than the tarsi. Spurs bright honey-yellow. First joint of the tarsi rather more than twice the length of the second; second joint almost one-half longer than the third; fourth and fifth joints of nearly equal length. Wings with a brownish-grey tint; densely covered with microscopic pubescence intermixed with some irregularly dispersed and considerably longer, bent hairs; rather brilliant pale green and rosy reflections. Veins brownish-grey. First longitudinal vein joining the costa before the base of the fork; cross-vein situated beyond the middle of the first longitudinal vein; tip of the second longitudinal vein and the tip of the posterior branch of the fork equally near the apex of the wing; petiole very pale and indistinct, longer than the anterior branch of the fork; branches of the fork slightly divergent at the tip; fourth longitudinal vein pale but distinct; anterior branch of the fourth longitudinal vein very little arcuated, posterior branch running rather close to the anterior branch for half its length, then turning somewhat abruptly to the posterior margin. *fy* almost twice the length of *gh*; *kl* a very little shorter than *lm*. Rudimentary fifth longitudinal vein rather close to the fourth longitudinal before branching, running very close to the posterior branch, and disappearing at about $\frac{2}{3}$ of its length.

♀.—Antennæ longer than the head and thorax together; flagellar joints sub-sessile, 2 to $2\frac{1}{2}$ times as long as broad. Thorax more densely pubescent than that of the ♂, the lateral longitudinal rows of hairs apparently treble. Halteres dusky. Legs dusky-brown with a yellowish tint, having a coarser pubescence than in the ♂. Abdomen pale umber-brown, with dusky reflections. Wings very densely covered with a somewhat interwoven pubescence, making the third longitudinal vein very indistinctly visible.

Hab.—Como (Masters and Skuse). September.

EXPLANATION OF PLATE.

PLATE XI.

Fig. 1. Alar-venation of *Sciara Macleayi*.

Fig. 2. „ „ *sedula*.

Fig. 3. „ „ *æmula*.

Fig. 4. „ „ *Trichosia Mastersi*.

Fig. 5. Diagram illustrating the terminology for the veins and cells as applied to the Sciaridæ.

[The dextral column gives the German equivalents employed by Winnertz, (*Beit. zu einer Mon. der Sciarinen*, 1867)].

Veins.	Adern.
Costa (<i>v. costalis</i>). a, e, g.	Randader.
Transverse shoulder-vein (<i>v. transversa humeralis</i>). b.	} Hülsader.
Auxiliary (<i>v. auxiliaris</i>). c.	
1st longitudinal (<i>v. long. 1ma</i>). a, e.	Unterrandader.
Cross-vein (<i>v. transversa marginalis</i>). d.	Querader.
2nd longitudinal (<i>v. long. 2da</i>). a, f.	Mittelader + Ellbogenader.
Anterior branch (<i>v. long. 2da ramus anterior</i>). s.	} Brachialader.
3rd longitudinal (<i>v. long. 3a</i>). n, p, k.	
Anterior branch (<i>v. long. 3a ramus anterior</i>). h.	Obere Scheibenader.
4th longitudinal (<i>v. long. 4a</i>). a, m.	Hinterader.
Anterior branch (<i>v. long. 4a ramus anterior</i>). l.	Untere Scheibenader.
5th longitudinal (<i>v. long. 5a</i>). n. (<i>Rudimentary</i>).	} Achselader.

<i>Cells.</i>	<i>Zellen.</i>
Sub-costal (<i>c. subcostalis</i>). A.	Randzelle.
Inner marginal (<i>c. marginalis interior</i>). B.	Schulterzelle.
Marginal (<i>c. marginalis</i>). C.	Vordere Cubitalzelle.
1st sub-marginal (<i>c. submarginalis 1ma</i>). D.	Hintere Cubitalzelle.
2nd sub-marginal (<i>c. submarginalis 2da</i>). E.	Obere Scheibenzelle.
3rd sub-marginal (<i>c. submarginalis 3a</i>). F.	Mittlere Scheibenzelle.
1st posterior (<i>c. posterior 1ma</i>). G.	Untere Scheibenzelle.
2nd posterior (<i>c. posterior 2da</i>). H.	Hinterzelle.
Axillary (<i>c. axillaris</i>). I.	Achselzelle.

SOME EXPERIMENTS WITH THE "CATTANACH DISINFECTANT AND DEODORANT," AS COMPARED WITH THE ORDINARY CARBOLIC POWDER.

BY DR. OSCAR KATZ.

For some time past a Sydney Company, the "Cattanach Chemical Works Company, Limited," has produced a preparation in the shape of a powder, called the "Cattanach Disinfectant and Deodorant," which is guaranteed by the firm "to destroy all disease germs and to thoroughly deodorize and disinfect all fæcal, foul, or decaying animal and vegetable matter." The inventor of this "improved disinfectant and deodorant," H. M. Caldwell, had it patented in Sydney, in August, 1887. From his specification as to its composition and mode of application I derive the following :—It represents a mixture of two different preparations ; let them be termed A and B. The former (A) consists of equal parts of nitrate of potash, peroxide of manganese, and hydroxide of potash, of which the first two are carefully mixed while the third is added after having been dissolved in a sufficient quantity of water. The moisture is then evaporated ; the now dry mass ground to powder, fused at a low red heat for about 24 hours, and steamed till it assumes a suitable running consistence. After this process it is neutralised with sulphuric acid and allowed to crystallise by evaporation. The second preparation (B) is sulphate of iron, "from which all sulphuric acid is driven off by roasting at 212° to 900° F." This is "to minimise the action of any sulphuric acid upon vessels in which the powder may be used." "One part of (A) is then carefully mixed with 48 parts of (B), and with one part of peroxide of

manganese, and one part of hydroxide of sodium, and the whole ground together." That constitutes the "Cattanach Disinfectant and Deodorant," of which five to six ounces shall suffice for about one cubic foot of noxious matter.*

For medicinal disinfection, the inventor says, in cases of epidemics of cholera, typhoid, &c., one part of corrosive sublimate is added to the above product before package, but, he says further, with or without corrosive sublimate it acts as described.†

*Supposing such noxious matter to have the same or about the same specific gravity as distilled water, and taking the mean out of the above quantities, *i.e.*, $5\frac{1}{2}$ oz., the proportion in weight of the disinfectant and deodorant to such noxious matter, would be about 1:180. In taking, however, nightsoil for instance to be treated in the way indicated, this proportion would, of course, turn out to be still smaller.

†The samples used in my experiments were obtained at different times from Elliott Bros., wholesale druggists, Sydney, in tins of about 10oz. contents. They all bore the same label with regard to directions for use, and to their efficacy of destroying germs, &c. These samples did not contain any corrosive sublimate. I regret to have been without knowledge of there being a variety of the above powder containing sublimate till the undermentioned experiments were nearly concluded. The effect of corrosive sublimate by itself as an antiseptic and germicide for numerous bacteria is well studied; and should we find, what is highly probable, that the "Cattanach preparation" is more effective with the addition of bichloride of mercury to it than without it, it stands to reason such an action is brought about by the latter-named substance only. The powder is packed in tins of various sizes; the retail price of about 10oz., as contained in the smallest tins, is 6d. As is seen by the variability of the colour of this powder and other appearances, the process of preparation does not appear to be always constant. On opening a number of tins I have found it to exhibit different shades of a grey or greenish-grey colour. There was no perceptible smell in any of these specimens. On the other hand, the contents of two other tins which I received too late in order to compare their properties with those of the above-named description, were of a reddish-brown colour, accompanied with a smell like that of eucalyptus oil. All the samples that have come under my notice contained a small amount of fine particles of charcoal.

It is not known to me that exact experiments, especially on pure cultures of pathogenic bacteria, have yet been made with this novel preparation, and as there seems to be a large weekly output of, and a good sale for, this article in some of the Australian colonies, I thought it worth while to test its alleged efficacy in a few cases. I may mention before-hand that for each series of experiments carried out I used a freshly opened tin, the contents of which showed a greyish or greenish-grey colour (conf. above). It being advisable to submit to the very same tests, and under precisely the same circumstances, another largely used substance, with the effects of which in regard to disinfection and deodorization those of the "Cattanach preparation" could be compared, I chose the well-known flesh-coloured "Carbolic Disinfectant, Antiseptic, and Deodorizing Powder," which is sold in yellow tins, with black scripture printed on them.

From a practical point of view it seemed very desirable to know what, if any, value the new substance under consideration has, as a germicide for the bacillus of typhoid fever, this disease being the most fatal of infectious human diseases in Australia. It will, I think, not be quite out of place here to point out in a few words that only a few years have elapsed since the time when we became acquainted with pure cultures of the above micro-organism. A number of investigators have since been at work in the study of this bacillus, and although it has not been proved yet that by transmission of the cultivated micro-organism into either animals or man, it can proliferate and set up the disease, typhoid fever (or, at least, a similar complexion of symptoms with regard to animals), most observers hold the above bacillus to be the causal excitor of the disease.

The material to be experimented upon by the "Cattanach Disinfectant and Deodorant" was obtained from a pure culture

that had been derived from a mesenteric gland of an undoubted case of typhoid fever, and had been transferred from gelatine to gelatine during a period of somewhat less than a year. It did not in any way differ from the *Bacillus typhi abdominalis* of Eberth-Gaffky. Of the purity of the above culture I convinced myself by means of Koch's plate-process; from the isolated typical colonies fresh gelatine-tubes were sown.

The arrangement of the experiments was as follows:—In a first series I inoculated with the bacillus some small Erlenmeyer's flasks containing ordinary meat-broth of a slightly alkaline reaction,* and placed in a thermostat for two days at a temperature of 32-34°C. After this period the nourishing liquid had assumed a suitable degree of turbidity. I then mixed the contents of all the flasks together, and filled a number of sterilised 1 oz. = 28 ccm. flasks, each with 10 ccm. of the infected broth (conf. p. 736). These were then charged with certain quantities of the "Cattanach powder," and in a parallel manner with the "Carbolic powder." Tests for ascertaining the effect of these substances were made from time to time, as will be seen from the table below. I may here at once state that in these experiments as well as in the following ones, liquid and powder, immediately after the addition of the latter, were carefully mixed with one another, then allowed to stand at the temperature of the room undisturbed till a test was to be made, when they were stirred up again, and so on. A flask containing the respective liquid without any addition served for control-experiments each time. The same platinum-loop was used in all cases for transferring minute samples of the test-material (one loop full) to an 8-10 p.c. nutrient gelatine (slightly alkaline), that having been liquefied for that purpose at 40°C., and less, was made to solidify along the inner walls of the

*The same as used in the preparation of nutrient gelatine, agar-agar, etc., without the addition of any further substance.

test-tube (after Esmarch). The test-tubes were kept under observation for at least a fortnight at ordinary temperatures.

Whether bacteria grew in the culture-tubes or not, was seen by the appearance or non-appearance of colonies in them. That, speaking of the experiments with typhoid bacilli, the colonies which made their appearance were in fact such of the named bacillus, was proved by their macroscopic and microscopic examination; it must also be borne in mind that the object under consideration was a pure culture of a well-characterised micro-organism. The presence of a minute portion of the two kinds of disinfectants, as transferred along with the broth to the culture tubes, did not in any case prevent the bacillus from developing; in case of the culture-medium remaining sterile from the very first, it was inoculated with living culture-material of the same bacillus, when after sometime a normal growth of the organism could be noticed.

A second series of experiments on the typhoid-bacillus differed in its arrangement from the former, in so far as the culture-medium for the bacillus was meat-broth that had not been deprived of the flocculent and rather tenacious masses of coagulated albumen, which is formed by boiling the beef-infusion. Such a nutritive soil resembling as it were artificial typhoid dejecta, has been made use of before by Liborius.* Of this material 25 gr. each were filled into a number of sterilised Erlenmeyer's flasks, inoculated with a minute and equal quantity of a pure-culture and allowed to stand in the thermostat for two days, at about the same temperature as before. Afterwards they were charged with definite and proportionally the same quantities, as before, of the two powders to be examined.

In the appended tables (pp. 736-737) I give an account of the arrangement and of the results of the above experiments.

**P. Liborius*, Einige Untersuchungen über die desinficirende Wirkung des Kalkes. Zeitschr. f. Hygiene. Bd. II., Heft 1, Leipzig, 1887, p. 41.

The results of these experiments show that the "Cattanach powder," under the above conditions, possesses very slight germicidal properties with reference to the bacillus of typhoid fever, and stands in this direction far behind the "Carbolic powder." In the first set of experiments the powder could act freely on the micro-organisms, which were suspended in a homogeneous liquid ; in this case the results were more favourable than in the second series, when the micro-organisms, on account of portion of the culture-medium being a solid and rather tenacious substance, were less easily accessible. I forgot to mention that the gelatine-tubes in the latter case were sown with a platinum-loop full of partly solid, partly liquid material out of the flasks under treatment, and this seed material stirred for some time in the liquid gelatine, which was then solidified as usual.

One inconvenience in experimenting with the "Cattanach preparation" was this. In adding to the meat-broth when the latter was less than ten times as much in weight as the former, and mixing the two with each other, the mixture, under a slight production of warmth, and under the emission of a peculiar sweetish smell, began slowly to rise like beer-yeast, and, unless attention was paid to it, and the glass vessels spacious and high enough, threatened to drive out the cotton-wool stoppers and to flow over. After the mass had subsided again, the inner walls of the flasks showed some of the powder rather firmly attached to them, so that the percentage of powder in the liquid to be disinfected was in reality a trifle smaller than originally intended.*

The relative quantities of "Cattanach powder" which I took were very considerably larger than those which the inventor of it

*In looking at one case (10 ccm. of infected broth without albumen +2 gr. "Cattanach") the loss was more apparent than in others.

directs to be taken (see p. 728), and larger than generally employed *in praxi*. It is evident that as the compound had, under the given conditions, so little effect on the typhoid-bacillus cultivated at a temperature of 31-34° C.,* there will be no more marked effect, probably even less, should it be used for the disinfection of the dejecta from typhoid fever patients.

In order to test whether the "Cattinach powder" is a preventative of putrefaction, I prepared some mixture capable of putrefaction, consisting of ten parts of ordinary Sydney tap-water, with the addition of one part of minced portions of fish (flesh, entrails, fæces). This mixture was contained in portions of 275 gr. in spacious glass flasks, and immediately after it had been prepared the "Cattinach powder," as well as the "Carbolic powder," were added in certain proportions. The contents of the flasks were well shaken, then allowed to remain undisturbed till samples were derived for culture-purposes. The arrangement of the experiments and the results they yielded may best be seen from table (p. 738).

In this it is shown that the "Cattinach powder" proved itself to be a good *antisepticum*, when added to a mixture of the above description in proportion of 1:5 and 1:10. With regard to the "Carbolic powder," it acted likewise antiseptically under the same arrangements, with the difference that when employed in the proportion of 1:10, the number of bacterial colonies were numerous, so much the more the older the mixture was ; but the colonies did

*Typhoid bacilli cultivated in meat-broth at the above temperature are easily destroyed by the addition of definite portions of boiling water. Repeating the experiments by Dr. Vilchur, of St. Petersburg (*Lancet*, Jan. 14, 1888, p. 87), I found (one experiment) that no growth in nutrient gelatine resulted from samples of such infected broth, if only an equal volume of boiling water had been added to it.

not belong to putrefactive organisms ; the gelatine did not become liquefied, nor was there any putrefactive smell. On the other hand in all control-tests the gelatine became rapidly liquefied under stink.

In order to obtain some information as to whether the "Cattanach" possesses deodorizing properties, I employed a putrefying mixture, emitting a disgusting stink ; it had been prepared in the same way as above (10 parts of water, 1 part of minced fish). Samples of this mixture in portions of 150 gr. each were distributed in suitable glass-flasks, the two powders added in the proportion of 1:150, 1:50, 1:25, 1:10, and thoroughly mixed with the contents of these flasks. The result was this—the "Cattanach powder" was superior in its action to the "Carbolic powder." In the flasks containing the "Cattanach" in the proportion 1:10 and 1:25 the really sickening stench had disappeared entirely (first case), or nearly so (second case) after about four hours, whereas in the proportion of 1:50 this state was attained not until after about a day. The condition of the flasks was still the same after 25 days. However, in the flask containing the Cattanach in the proportion of 1:150 the stench did not disappear, although it was less strong than that emitted from the control-flask. On the other hand a thorough deodorization of the samples treated with "Carbolic powder" had not taken place in either of them after three days, although the stench had considerably diminished, we may say, pretty nearly ceased in the flask with "Carbolic powder" in the proportion of 1:10. After seven days the deodorization was complete, and so it remained. The sample containing the powder 1:25 was not quite deodorized after seven days ; on examination after 25 days it was found free from any offensive smell, and so was the sample with the "Carbolic powder" in the proportion of 1:50. (After this period the control-flask still emitted a bad smell). Lastly, there was not much difference

between the condition of the flask with Carbolic powder, 1:150, and that of the control-flask, after 25 days ; in this respect the matter was about the same as with the corresponding Cattanaeh experiment.

In putting together the results of the above experiments, we may say that the "Cattanaeh Disinfectant and Deodorant" falls short of being a germicide for the bacillus of typhoid fever, and therefore cannot be employed in the disinfection of typhoid dejecta; it acts antiseptically, at least to a certain extent, as is shown above ; and, lastly, it is a quick deodorizer, but not in so small proportions as are stated in the directions regarding its use. From what I have been able to see, the composition of the preparation (to judge from colour, smell, and general appearance) is not constant, and failing in this way there cannot be any guarantee for its having constant properties. Besides, some objection might be taken, in my opinion, to the price of the powder, which by far exceeds that of other preparations for the same purpose.

TABLE SHOWING ARRANGEMENT AND RESULTS OF THE ABOVE EXPERIMENTS.

Object experimented upon.	Quantity of material to be tested, as added to the former.	Intervals at which cultures in 8-10 p.c. nutritive gelatine were prepared.	Cattanaeh Powder.	Carbolic Powder.	Control Experiment.
Culture of the bacillus of typhoid fever in meat - broth, in portions of 10ccm.	5 gr. (1:2). [mixture contained in a larger flask in the case of Cattanaeh powder.]	after 1½ hours	35 typh. col.	sterile (2 foreign bact. col.)	numberless colonies.
		after 4 hours	23 typh. col.	sterile (2 foreign col. 1 bact., 1 mould.)	no diminution.
		after 24 hours	1 typh. col.	sterile (2 foreign bact. col.)	no diminution.
		after 3 days	sterile	sterile	no diminution.
	2 gr. (1:5). [conf. foot-note, p. 732.]	after 4 hours	1434 typh. col.	2 typh. col.	as above.
		after 24 hours	2452 typh. col.	sterile	as above.
		after 3 days	437 typh. col.	sterile	as above.
		after 6 days	11 typh. col.	sterile	no apparent diminution.
	1 gr. (1:10).	after 24 hours	1144 typh. col. (1 foreign bact. col.)	9 typh. col. (1 foreign bact. col.)	as above.
		after 3 days	28 typh. col.	sterile	as above.
		after 6 days	sterile (1 mould col.)	sterile	as above.

TABLE SHOWING ARRANGEMENT AND RESULTS OF THE ABOVE EXPERIMENTS :—*Continued.*

Object experimented upon.	Quantity of material to be tested, as added to the former.	Intervals at which cultures in 8-10 p.c. nutritive gelatine were prepared.	Cattanaeh Powder.	Carbolic Powder.	Control Experiment.
Culture of the bacillus of typhoid fever in meat-broth and coagulated albumen, in portions of 25 gr.	12.5 gr. (1:2).	after 1½ hours	8433 typh. col.	sterile	numberless colonies.
		after 4 hours	6492 typh. col.	sterile	numberless colonies.
		after 24 hours	3159 typh. col.	sterile	numberless colonies.
		after 8 days	28 typh. col.	sterile	no apparent diminution.
	5 gr. (1:5).	after 4 hours	9295 typh. col.	309 typh. col.	as above.
		after 24 hours	11,569 typh. col.	sterile (1 mould col.)	as above.
		after 8 days	151 typh. col.	13 typh. col.	as above.
		after 24 hours	14,678 typh. col.	colonies too numerous to be counted, but less numerous than in control flask.	as above.
	2.5 gr. (1:10).	after 8 days	decrease, but still a large number	2013 typh. col.	as above.

Object experimented upon.	Quantity of material to be tested, as added to the former.	Samples derived for cultivation in nutr. gelatine.	Cattanach Powder.	Carbolic Powder.	Control Experiment.
Artificial mixture capable of putrefying, before putrefaction had set in ; in portions of 275 gr.	55 gr. (1:5).	after 68 hours	sterile	28 bact. col. (of which only a few yellow liquefying ones).	numberless col.; gelatine rapidly liquefied.
		after 11 days	2 bact. col. (non-liquefying).	2 bact. col. (non-liquefying).	numberless col.; gelatine rapidly liquefied.
		after 28 days	1 bact. col. (non-liquefying), and number of white mould-col.*	2 bact. col. (of which 1 non-liquefying, 1 liquefying, yellowish-brown), 1 mould col.	numberless col.; gelatine rapidly liquefied.
	27.5 gr. (1:10).	after 68 hours	sterile	2591 bact. col. (non-liquefying).	as above.
		after 11 days	1 bact. col. (non-liquefying).	3825 bact. col. (non-liquefying ; pink and white).	as above.
		after 28 days	1 bact. col. (non-liquefying).	17,793 bact. col. (non-liquefying ; pink and white).	as above.

* After this period an interrupted layer of some mould had formed itself at the surface of the mixture.

NOTES AND EXHIBITS.

Messrs. Etheridge and David exhibited on behalf of the Government Geologist, portions of the skeleton of an Aboriginal found by them in an extension of the Pumice bed at Long Bay, near Botany. The bones were reposing in a hollow, $3\frac{1}{2}$ feet \times $2\frac{1}{2}$ feet, excavated in a consolidated sand bed, the top of which was much hardened, and had formed an old land surface. With the remains were found two stone implements and some shells, covered by the material excavated from the hollow and a little drift sand, the whole being buried in the blown sand of the Pumice bed at a depth of 3 feet odd. The last-named deposit now forms the present land surface, and supports a vigorous vegetation, the surrounding ground containing stumps of what must have been large trees. The pelvis, leg bones, fore-arm bones, feet, hands, sacral and lumbar vertebræ, and the three lowest dorsal vertebræ were all found, but the remaining portions of the skeleton were wanting. The thickness of the consolidated sand bed in which the hollow had been made varies from 4 to 20 feet, and rests on beds of the Hawkesbury Series, the whole forming a section of 27 feet at the immediate spot in question, presenting a low seacliff at the bottom of the bay. This must have been a very old interment, and is conjectured to be perhaps the earliest remains of man yet found in New South Wales. The subject has been communicated to the Government Geologist in the form of an official report.

Mr. Maiden exhibited two clusters of the seed-capsules of *Eucalyptus pilularis*, sessile on the larger branches of a vigorous tree. A large number of such clusters might have been gathered; and Mr. Maiden asked if any members present had met with a similar experience, as this condition was one that he had not previously observed.

Mr. S. Sinclair exhibited a gold watch found in the stomach of a shark (*Galeocерdo rayneri*) captured in Port Jackson last January by Messrs. Smith and Ireland.

Mr. Palmer read the following note on Sympathy and Foster-parentage among Birds :—

“Several instances of foster-parentage have recently come under my notice in connection with both wild and domesticated birds, which it may be interesting to record. In my own garden at Burwood for two successive seasons a pair of blue wrens have hatched and reared young bronze cuckoos, and a pair of honey-eaters (*Ptilotis fusca*) a cuckoo (*Cuculus inornatus*); and I have repeatedly seen six honey-eaters busily engaged in feeding the young cuckoo which they seemed quite unable to satisfy, the small morsels they could bring him, though continuously supplied, being inadequate to appease his hunger. The fact of six small birds such as *Ptilotis* voluntarily devoting themselves to rear such an incongruous bantling, so much larger and so utterly unlike their own species, is a remarkable instance of sympathy. Some time ago a boy brought in an egg found near a waterhole, which was placed with other eggs under a sitting hen, and in due course hatched out a wood-duck. The wood-duck was reared among a clutch of chickens, was as well tended as her other chicks by the mother hen, and reached adult age. On one occasion a hen brought out a brood of chickens, and the wood duck kept in close companionship with the hen and chicks for several days, until the hen took umbrage at the duck's constant attendance, and several fights between the hen and duck ensued. Eventually the duck drove away the hen, and took sole charge of the chickens throughout the day, the hen following round disconsolately till night-fall each day, when the duck surrendered her charge, allowing the mother to brood over them at night, but again taking charge of them in the morning. This continued till the chickens were able to take care of themselves. I have now at Lawson a young pullet which has voluntarily taken upon herself the care of four orphan chickens. The mother hen died on the nest, and her clutch of eggs was hatched out by placing in a box in the manure heap. Eleven chickens were brought out, but gradually died off till only four were left. The chirping cry of the motherless chickens attracted the notice of a half-grown pullet, which had never laid an egg, and she has not only taken full charge of the orphans but has

assumed all the usual attributes of a brooding hen, using the same notes of call and warning that are peculiar to a mother hen, and scratching and searching for food for them with equal assiduity. The young chicks are now about a month old; the foster mother about five months old."

Mr. A. Sidney Olliff exhibited a nest of a social caterpillar belonging to the Bombycidae which had recently been sent to the Australian Museum by Mr. E. G. Dyce, who had found it in the neighbourhood of Harefield. The nest was a bag-like structure about 7 inches long and $2\frac{1}{2}$ inches wide, and was found attached to the bough of a Eucalypt. The exterior of the nest was light brown in colour, with the texture and appearance of parchment, and the walls were supported within by gum-leaves which had been worked into their substance. The only opening was from below. When first received the nest was occupied by some dozens of larvæ, brown hairy creatures of the ordinary bombyciform type, but subsequently they left their covering. Mr. Olliff said the larva was evidently processionary in its habits, but until he had succeeded in rearing the moth it was impossible to say to what genus it belonged. Whether the larvæ undergo their transformations within the nest—as in the case of *Anaphe*, an African nest-maker—or whether they desert the nest before assuming the pupal condition were points which could only be decided by direct observation, but Mr. Olliff was inclined to think that the latter would prove to be the case. It was to be hoped that more material would be forthcoming as, unfortunately, the chances of rearing the moth from the present nest were small, owing to the larvæ being infested with Ichneumonidæ.

Mr. Skuse exhibited specimens of the 41 species of Diptera described in his paper.

Mr. Ogilby exhibited a specimen of a rare Percoid fish, *Anthias* (*Pseudanthias*) *cichlops*, Blk., recently received from Lord Howe Island. He remarked that, so far as he could ascertain, but one other specimen, Dr. Bleeker's type, was known, and this was obtained at Priamam, on the west coast of Sumatra. It is remarkable for being much more elongate than is usual with this genus.

WEDNESDAY, 27TH JUNE, 1888.

Dr. Cox, F.L.S., Vice-President, in the Chair.

The Chairman announced that the next Excursion had been arranged for Saturday, July 21st. Members to leave Redfern Station by the 8·22 a.m. train for National Park.

DONATIONS.

“The American Naturalist.” Vols. I.-XX. (1867 to 1886); “Encyclopædia Britannica.” Vol. XXIII.; “A Manual of Injurious Insects, with Methods of Prevention,” &c. By Eleanor A. Ormerod, F.M.S., &c.; “Bacteria” By Dr. Antoine Magnin, and Dr. George M. Sternberg; “Insecta Saundersiana—Vol. I., Diptera.” By Francis Walker, F.L.S.; “The Geological Record for 1879;” “Zeitschrift für wissenschaftliche Zoologie.” XLVI. Band, 2 Heft. *From the Hon. William Macleay, F.L.S., &c.*

“The Canadian Record of Science.” Vol. III., No. 2 (1888). *From the Natural History Society of Montreal.*

“The American Naturalist.” Vol. XXII., No. 255 (March, 1888). *From the Editors.*

“Bulletin of the Museum of Comparative Zoology at Harvard College, Cambridge, U.S.A.” Vol. XIII., No. 8; Vol. XVI., No. 1 (1888). *From the Curator.*

“Notes on the Distribution of Iron Ores in the United States;” “Description of a New Crustacean from the Clinton Group of Georgia, with Remarks upon others.” By Anthony W. Vogdes, U.S. Army. *From the Author.*

"The Journal of Comparative Medicine and Surgery." Vol. IX., No. 2 (1888). *From the Editor.*

"Abstract of Proceedings of the Zoological Society of London," 17th April, and 1st May, 1888. *From the Society.*

"Zoologischer Anzeiger." XI. Jahrg., Nos. 277-279 (1888). *From the Editor.*

"The Journal of Conchology." Vol. V., No. 10 (1888). *From the Conchological Society of Great Britain and Ireland.*

"Journal of the Royal Microscopical Society, London, 1888." Part 2. *From the Society.*

"Proceedings of the Academy of Natural Sciences of Philadelphia, 1887." Part 2. *From the Academy.*

"Verhandlungen der k. k. zoologisch-botanischen Gesellschaft in Wien." Jahrg. 1887, XXXVII. Band, Parts 1 and 2. *From the Society.*

"Mémoires de l'Académie Impériale des Sciences de St. Pétersbourg." 7-me. Série. Tome XXXV., Nos. 2 and 3 (1887). *From the Academy.*

"United States Geological Survey—First Annual Report," (1880). By Clarence King, Director; "Second, Third, and Fourth Annual Reports" (1880-83). By J. W. Powell, Director. *From the Director.*

"Proceedings of the American Philosophical Society, Philadelphia," Nos. 96 to 126 (Vols. XV. to XXIV., 1876-87); "Laws and Regulations;" "List of Members;" "List of Surviving Members;" "Register of Papers;" Proceedings at the Dinner commemorative of the Centennial Anniversary;" "Mémorial of George B. Wood, M.D., L.L.D." *From the Society.*

"Bulletin de la Société Zoologique de France." Tome XIII., Nos. 2 and 3 (Feb. and March, 1888). *From the Society.*

"Abhandlungen herausgegeben vom naturwissenschaftlichen Vereine zu Bremen." X. Bd., 1 & 2 Heft (1888). *From the Society.*

“Bulletin de la Société Belge de Microscopie.” XIV. Année, No. 5 (1888). *From the Society.*

“The Victorian Naturalist.” Vol. V., No. 2 (June, 1888). *From the Field Naturalists' Club of Victoria.*

“Feuille des Jeunes Naturalistes.” No. 211 (May, 1888); “Catalogue de la Bibliothèque.” Fasc. No. 3. *From the Editor.*

“Videnskabelige Meddelelser fra den naturhistoriske Forening i Kjöbenhavn for Aaret 1887.” *From the Society.*

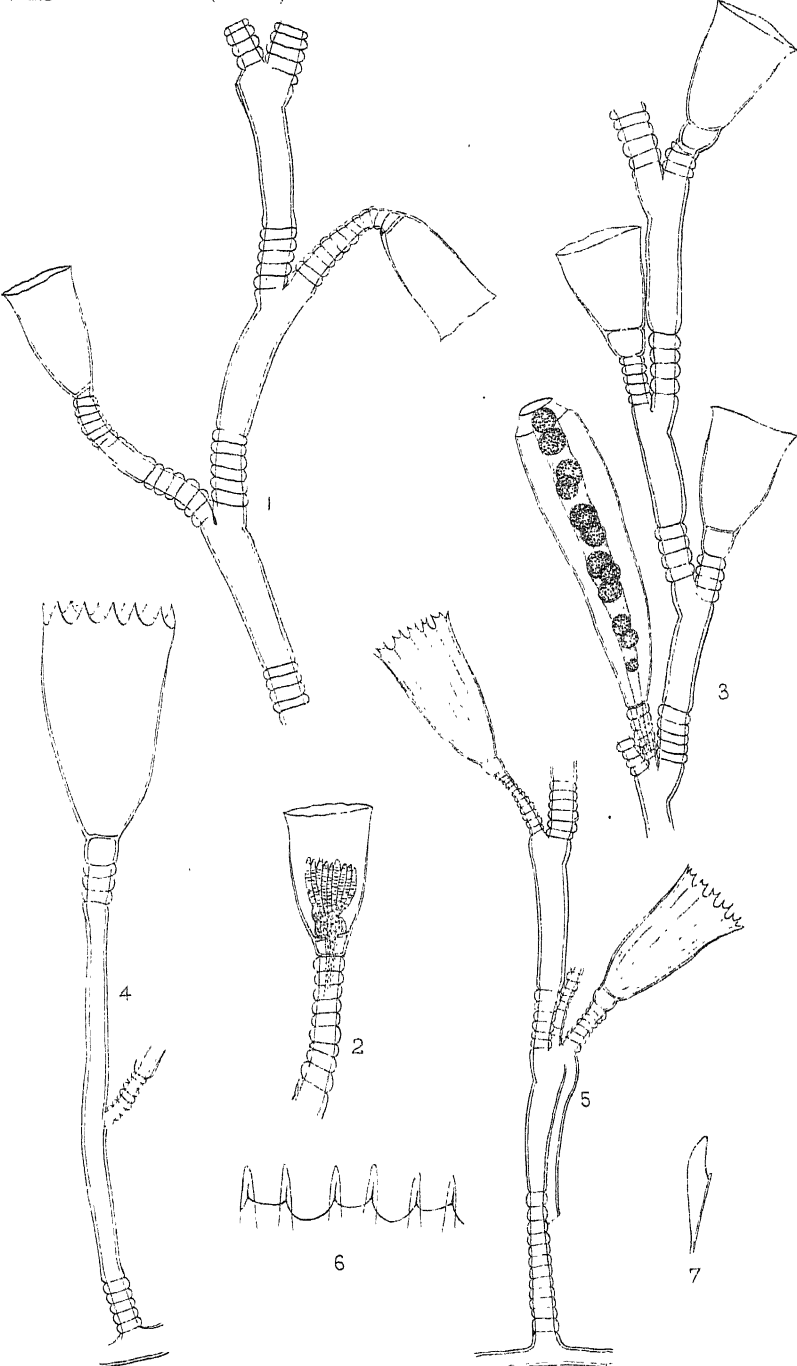
“The Goldfields of Victoria—Reports of the Mining Registrars for the quarter ended 31st March, 1888.” *From the Secretary for Mines, Melbourne.*

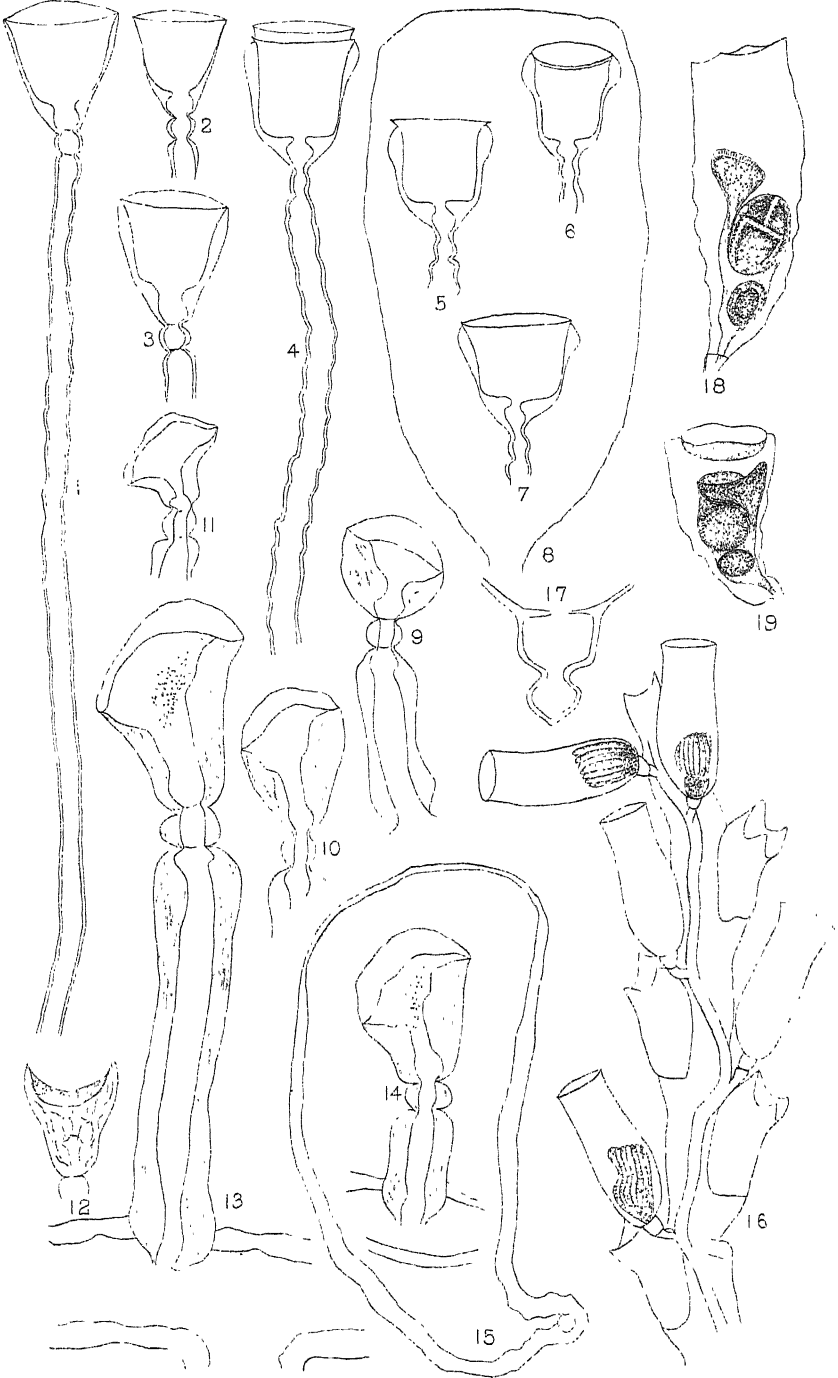
“Mémoires de la Société Nationale des Sciences Naturelles et Mathématiques de Cherbourg.” Tomes XIII.-XV.; XVII.-XIX.; XXI.-XXIII.; XXV. (1867 to 1885). *From the Society.*

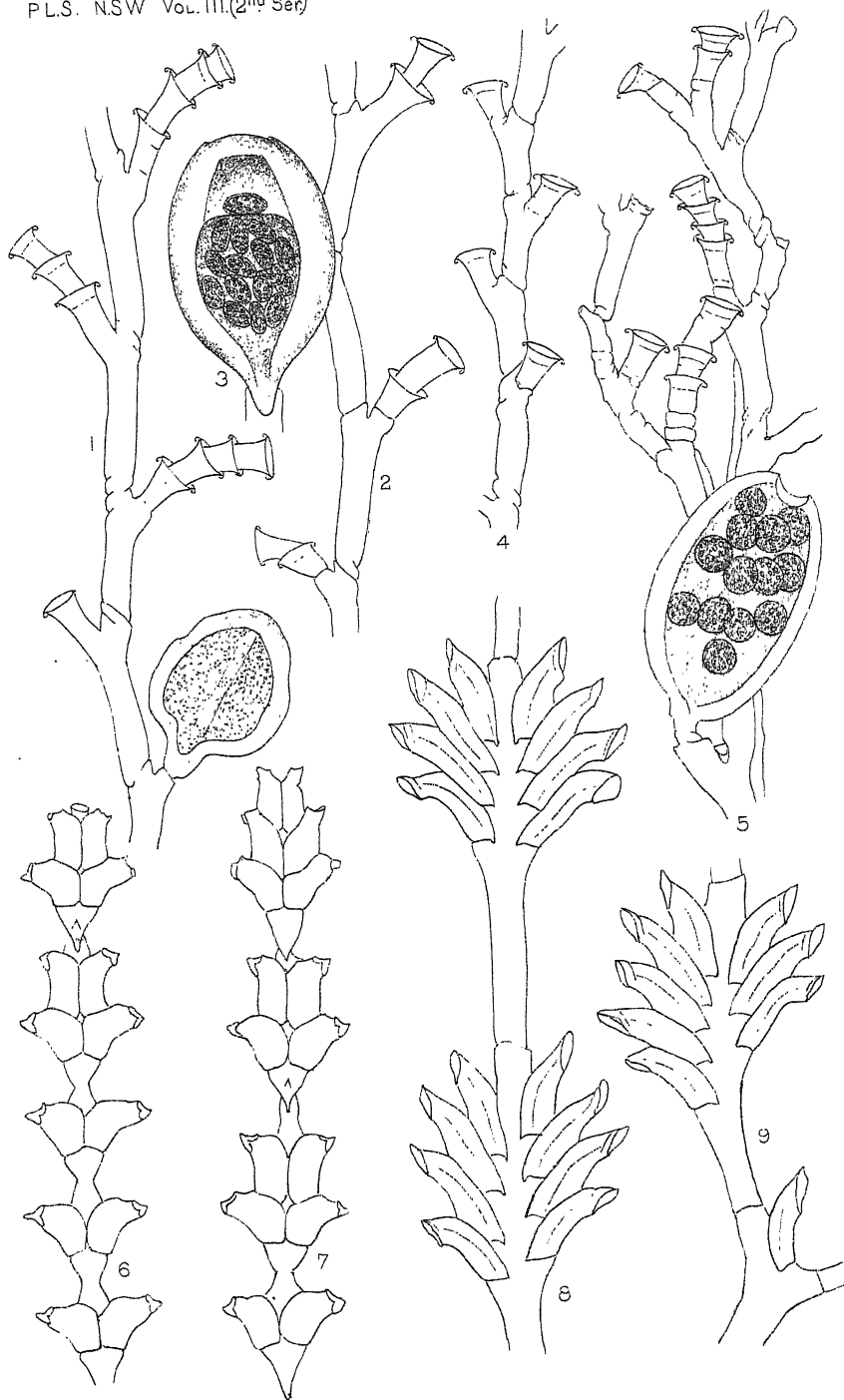
“The Australasian Journal of Pharmacy.” Vol. III., No. 30 (June, 1888). *From the Editor.*

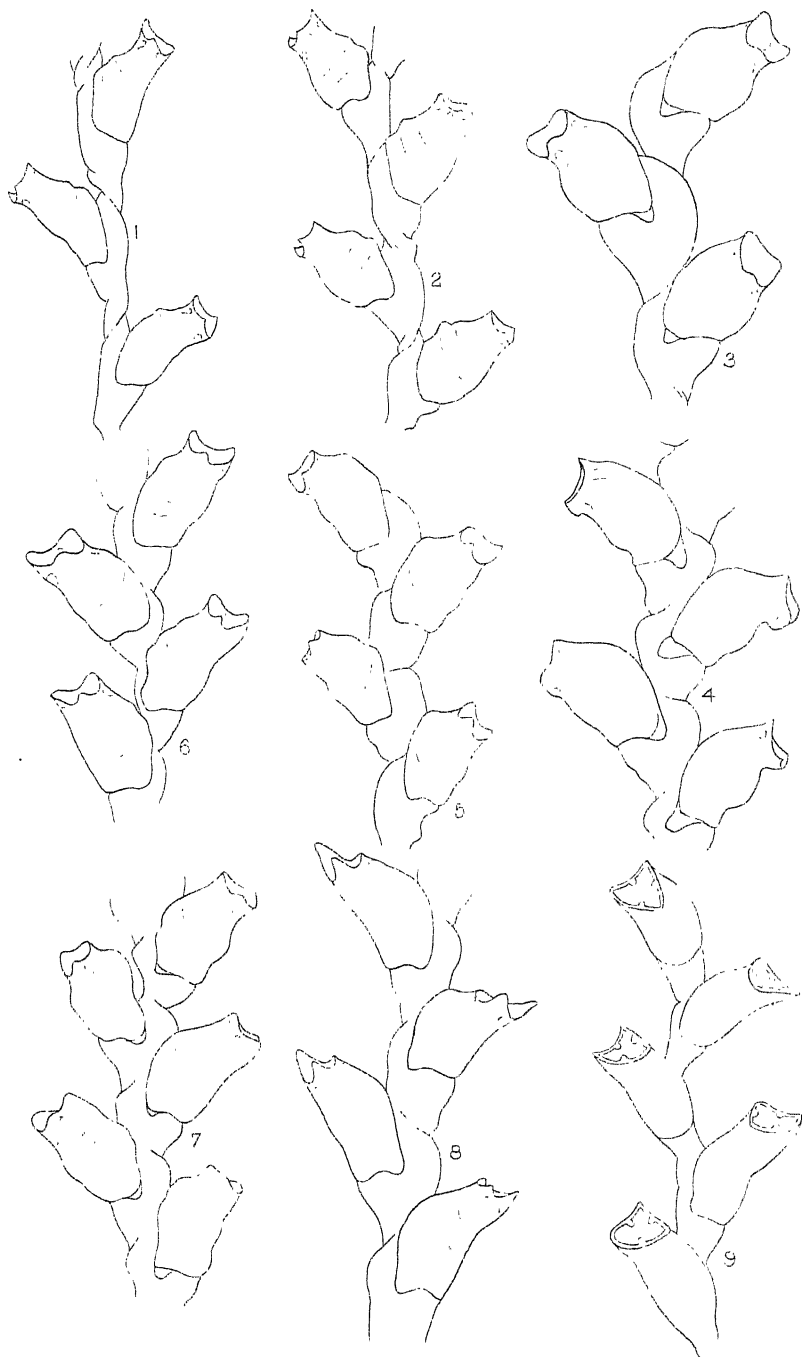
“Bollettino dei Musei di Zoologia ed Anatomia comparata della R. Università di Torino.” Vol. III., Nos. 39 to 43 (1888). *From the Museum.*

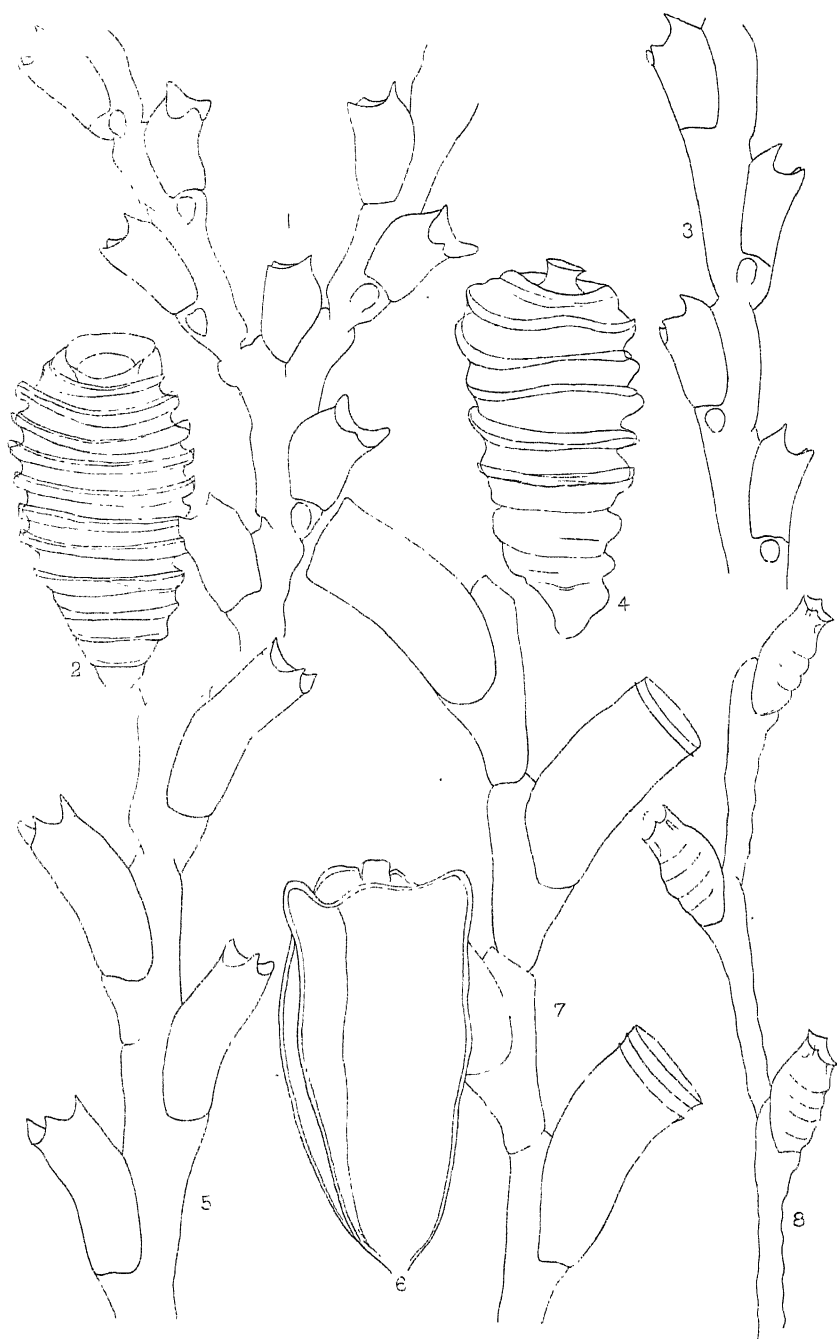
“Catalogue of the Fossil Mammalia in the British Museum, (Natural History).” Part V. (1887); “Catalogue of the Birds, &c.” Vol. XII. (1888); “Guide to the Shell and Starfish Galleries.” *From the Trustees.*

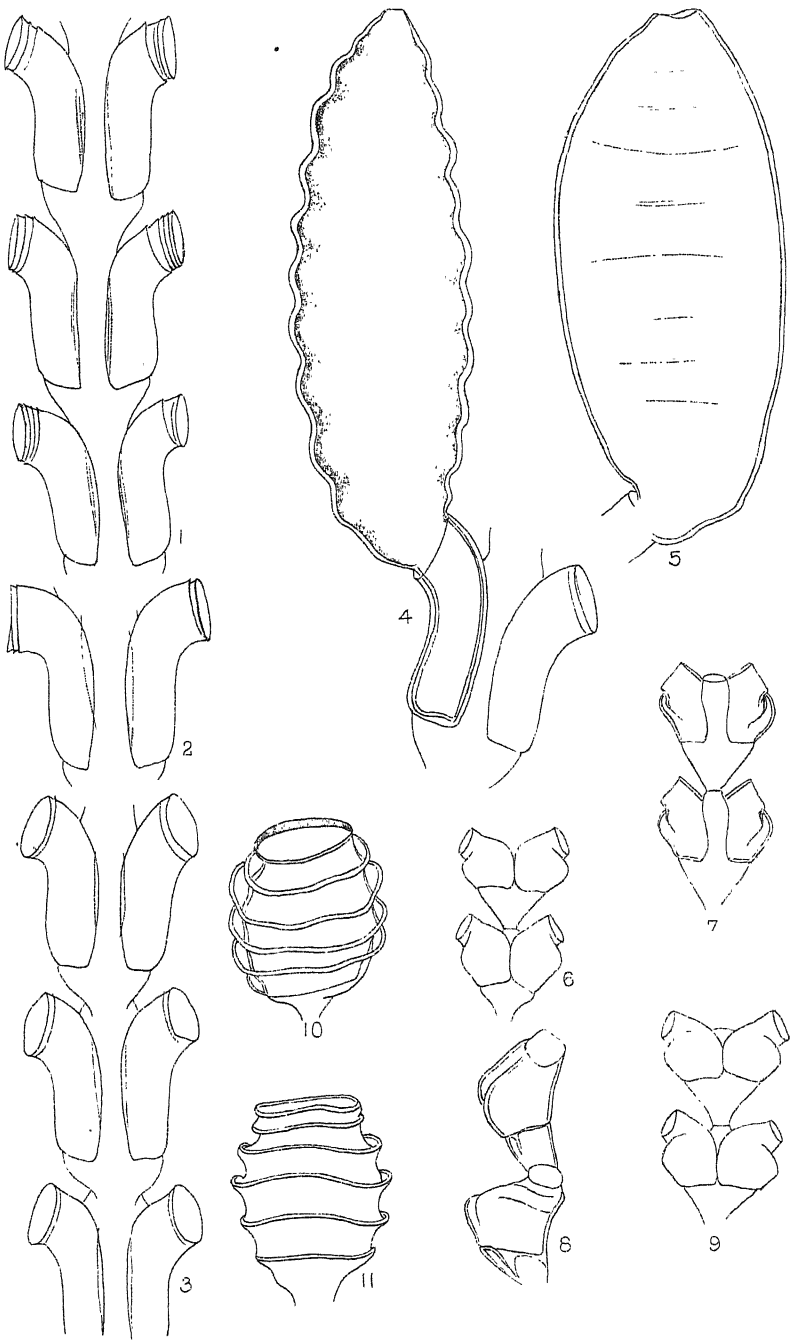


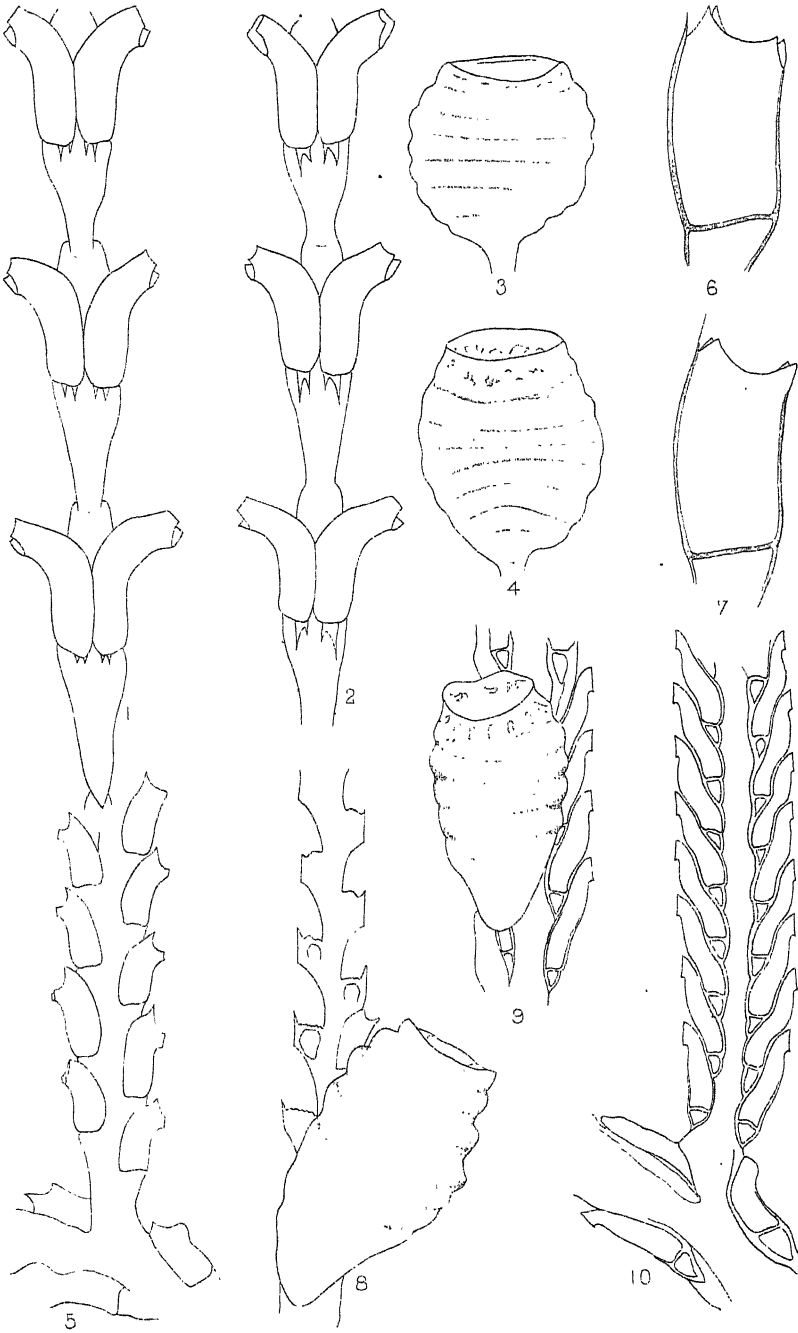


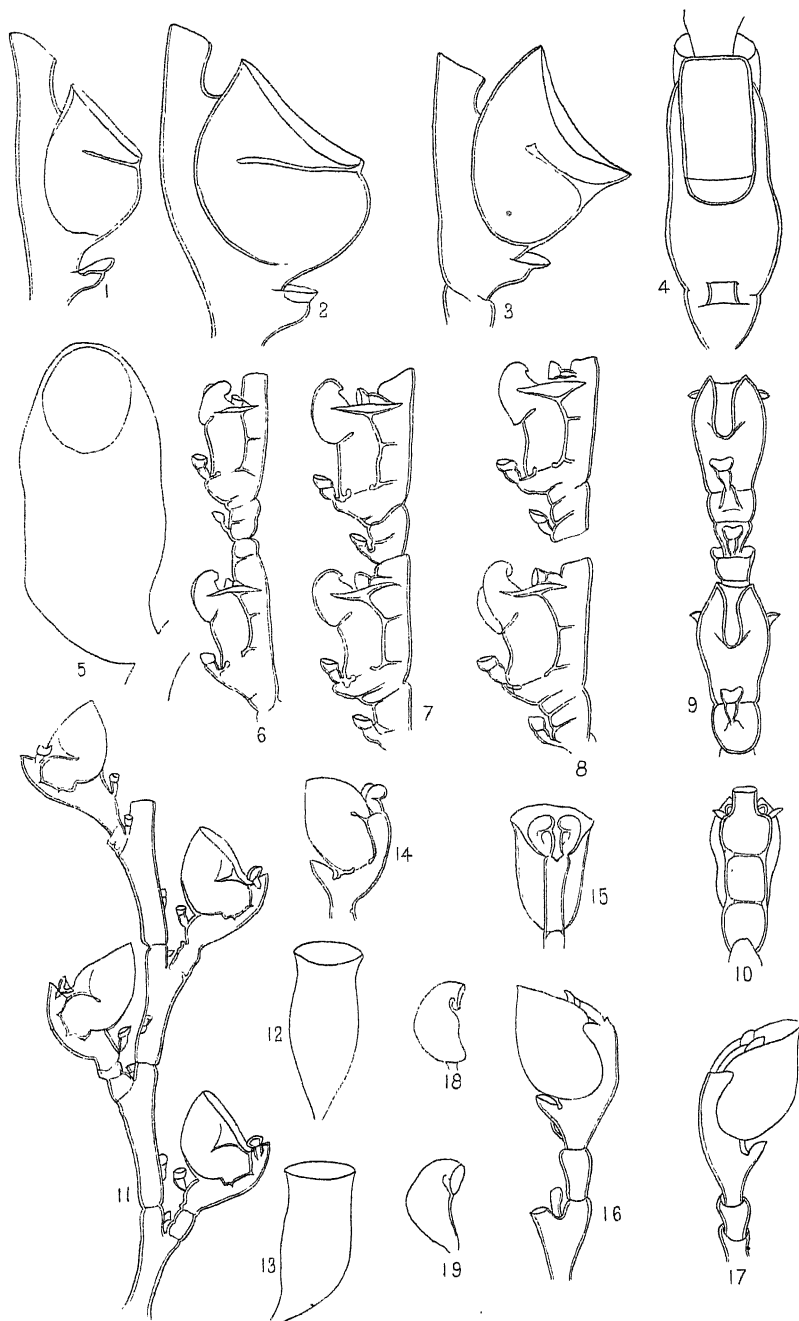


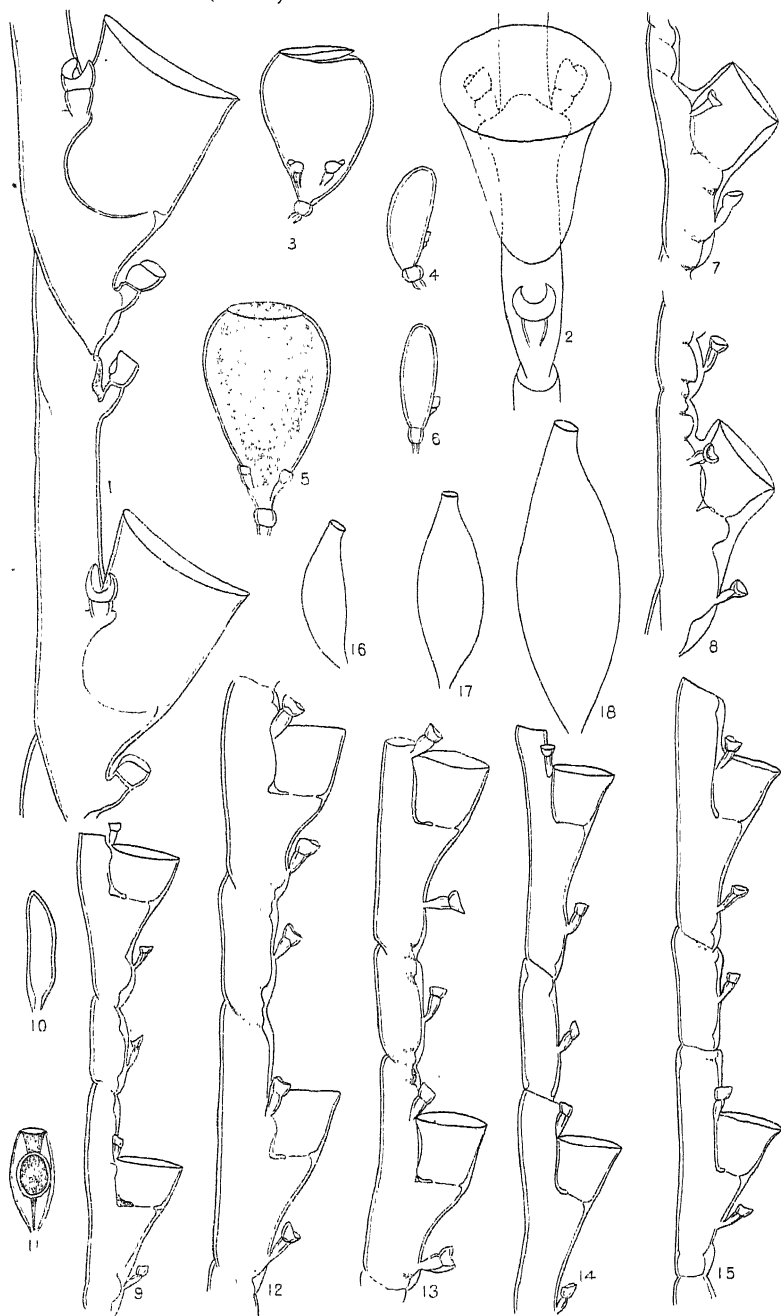


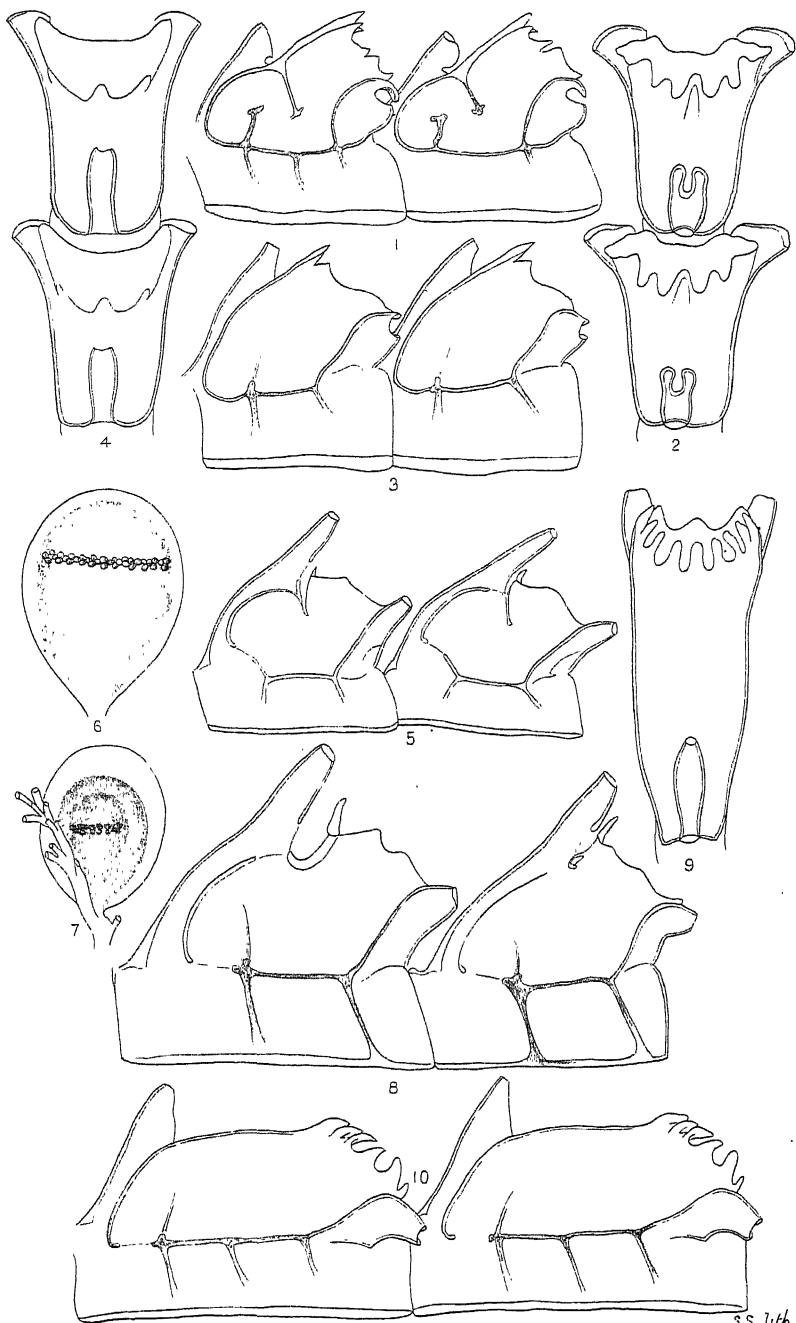












PAPERS READ.

ON SOME NEW AND RARE HYDROIDA IN THE
AUSTRALIAN MUSEUM COLLECTION.

BY W. M. BALE, F.R.M.S.

(PLATES XII.-XXI).

The species of Hydroida treated of in the present paper were (with one exception) included in a collection sent to me by Dr. Ramsay, from the Australian Museum, about the end of the year 1886. Besides a number of new species there were represented several which had previously been very imperfectly known, for one of which—the *Ceratella fusca* of Gray—I have found it necessary to constitute a new family. Among the other specimens were a number of Dr. von Lendenfeld's types of the species described by him in the Linnean Society's Proceedings, several of which prove to be identical with species previously known. I have to thank Mr. T. Whitelegge, of the Australian Museum, for forwarding me additional specimens of some of the species, and also for notes of his examination of some of those in the Museum.

The type specimens from Dr. von Lendenfeld's collection, include the following—the references being to the Proceedings of the Linnean Society of N.S. Wales, Vol. IX.

SERTULARELLA MICROGONA, von Lendenfeld.

P.L.S.N S.W. IX., p. 416, Pl. VII., figs. 1-3. (See page 763).

DIPHASIA SYMMETRICA, von Lendenfeld.

l.c. p. 414, Pl. VIII., fig. 7.

This is identical with *Sertularia bispinosa*, Gray.

SERTULARIA FERTILIS, von Lendenfeld.

l.c. p. 406, Pl. VII., figs. 4-5.

This supposed species is founded on specimens of a *Thuiaria* (*T. sub-articulata*, Coughtrey), from which the brittle hydrothecæ have been broken away. The portions figured as hydrothecæ are not really such, but only the projecting portions of the hydrocaulus on which they have been supported, and the apparent teeth on the outer margins are merely remnants of the front of the hydrotheca, which are frequently left adhering when the rest of the cell is lost. I figure on Plate XVIII., fig. 8, a fragment of one of Dr. von Lendenfeld's type specimens, in which one of the hydrothecæ is preserved. I have another specimen from New Zealand, differing from Dr. von Lendenfeld's in the much lighter colour, and in this also most of the hydrothecæ are lost or injured.

Professor Allman describes *T. sub-articulata* (under the name of *T. bidens*) as having two teeth on the inner side of the hydrotheca and the rest of the margin smooth, while Mr. Coughtrey says that there are two teeth on the outer side, in addition to the inner two. The outer teeth are present in all the cells which I have seen, but it is often difficult to distinguish more than one tooth on the inner side.

PLUMULARIA GRACILIS, von Lendenfeld.

l.c. p. 476, Pl. XIV., fig. 17 ; Pl. XVII., figs. 28-29.

The type is a specimen of *P. Ramsayi*, Bale. Neither the detailed figure nor the description agrees with the specimen, which does not possess a mesial sarcotheca *above* the hydrotheca on the same internode, as represented.

PLUMULARIA RUBRA, von Lendenfeld.

l.c. p. 476, Pl. XIII., figs. 11-12 ; Pl. XIV., fig. 15. (See page 778).

PLUMULARIA TORRESIA, von Lendenfeld.

l.c. p. 477, Pl. XIII., figs. 13, 14 ; Pl. XIV., fig. 16 ; *P. campanula*, Busk. (See page 776).

PLUMULARIA TRIPARTITA, von. Lendenfeld.

l.c. p. 477, Pl. XII., figs. 8-10. = *P. setacea*, Ellis. (See page 778).

PENNARIA ROSEA, von Lendenfeld.

l.c. p. 594, Pl. XXIV., figs. 40-42.

This species is, as Mr. Whitelegge has pointed out to me, identical with the *P. australis* of the Catalogue of the Australian Hydroid Zoophytes. I have described this species as having 7-12 filiform tentacles, and 9-14 capitate ones, while *P. rosea* is stated to have 30-40 and 20-30 respectively. The discrepancy (especially in the number of the filiform tentacles) is very great, and I cannot account for it. I have examined many hydranths (including terminal ones) both from my original specimens and from Dr. von Lendenfeld's types, and have not succeeded in finding any with a larger number of tentacles than I have recorded, except in one or two cases where the number of capitate tentacles reached about 17. Mr. Whitelegge has kindly examined a number of specimens with the same result. The figure which accompanies Dr. von Lendenfeld's description shows a hydranth with not more than 10 or 12 capitate tentacles. I have not found the proboscis or oral portion separated from the rest of the body so sharply as shown by Dr. von Lendenfeld.*

P. australis is very closely allied to *P. symmetrica*, Clarke, the polypary especially so ; but the hydranths of *P. symmetrica* are ovate, not flask-shaped, and have about 30 capitate and 14-18 filiform tentacles.

*Dr. von Lendenfeld has a note, to which reference is wanting, at the foot of the page containing his description of *P. rosea*, referring to page 45 of the "Catalogue" (the description of *P. australis*) ; it is evident, therefore, that he intended at first to refer his specimens to that species, where they undoubtedly belong.

OBELIA AUSTRALIS, von Lendenfeld.

l.c. p. 604. (See page 753).

DIPHASIA RECTANGULARIS, von Lendenfeld.

l.c. p. 914, Pl. XLI., figs. 6-8.

This is synonymous with *Idia pristis*, Lamx. Fig. 7 shows part of a pinna with the hydrothecæ separated, but there is nothing of the kind in the type specimens, which are quite similar to that figured in the "Catalogue." The gonothecæ also agree with my former specimens, and not with Dr. von Lendenfeld's figure.

EUCOPELLA CAMPANULARIA, von Lendenfeld.

(See page 751).

A few other species were represented, but the specimens were too fragmentary, or not sufficiently well preserved, to be of much value.

CERATELLIDÆ.

Hydranths naked, sessile on processes of a chitinous reticulated polypary, tentacles all capitate, scattered irregularly over the body. Gonosome unknown.

CERATELLA FUSCA, Gray.

Hydrophyton forming a much ramified compressed structure, resembling a Gorgonian coral; polypary chitinous, of a dark brown colour, and of a finely reticulated structure, the main stem finally becoming very thick and irregular in form; branches gradually smaller towards the ends, very numerous and crowded: hydrophores (bracket-like projections of the hydrocaulus, which support the hydranths) arranged in a somewhat irregular sub-spiral manner round the branches, formed by slightly radiating ribs united by perforated laminae, the ribs projecting at the outer margin; meshes of the polypary filled with cœnosarc. Hydranths ovate, sessile

on the hydrophores, erect, armed with a number (about 8 or 10) of short capitate tentacles, which are scattered over the body without definite order.

Additional localities — Off Port Jackson Heads: Broughton Islands.

Mr. Brazier has already recorded in the Proceedings of the Linnean Society of N. S. Wales for 1886, page 575, the occurrence of *C. fusca* (not previously recognized since its original discovery by Gray) at various localities near Sydney, including Bondi Bay, where it was first obtained. Mr. Whitelegge informs me that it is found on Laminaria-roots.

From examination of a specimen which had been preserved in spirit, I find that the hydranths are not formed on the same type as those of *Hydractinia* (in which there is a single circle of filiform tentacles surrounding the base of a conical proboscis), but are armed with capitate tentacles only, which are distributed irregularly over the body. *Ceratella* must therefore be removed from the Hydractiniidæ, to which family it was assigned by Mr. Carter, in the absence of the hydranths, and must form the type of a new family—the CERATELLIDÆ—allied to the Corynidæ by the structure of the hydranths, and to the Hydractiniidæ by their sessile condition and by the character of the polypary. This however is not quite the same as in *Hydractinia*, being distinguished by its free and erect growth, as well as by other peculiarities. The basis of the structure (as seen in the new extensions at the ends of the branches), is a reticulated chitinous tissue, so like the skeleton of some of the horny sponges that a portion broken off and examined separately might well be mistaken for sponge-tissue. As growth proceeds this substance becomes denser and closer, and the superficial fibres in some parts usually run parallel, so as to leave channels between them. This is especially the case with the under side of the projections on which the hydranths are supported, to which I have applied the term "hydrophores," originally used by Professor Allman for the calyces of *Halecium*. These are formed by a number of longitudinal ribs which run along the

branch for some distance, and are continued outwards in a bracket-like form, spreading somewhat apart and united by chitinous matter which forms a sort of web with numerous perforations, so that the outer or lower side of the hydrophore presents the aspect of a number of channels bounded by the ribs, and having perforated or reticulated floors. On the upper side of the hydrophore further reticulations exist. When the polypary with the cœnosarc is examined by reflected light the whole mesh of the polypary is seen to be filled with the whitish cœnosarc, with the edges of the superficial fibres everywhere showing as a fine brown reticulation. The hydranths are stout ovate bodies like those of the genus *Coryne*, very little narrowed below, and seated directly on the hydrophore. I found a difficulty in counting the exact number of tentacles, owing to the specimens being imperfectly preserved, but there appeared to be usually about eight or ten, four or five of which generally surrounded the oral extremity, while the others were variously scattered over the body, one or two being often found quite close to the base. The capitula are large and globular, with such short stems that they appear almost sessile, but this may be caused by the contraction of the tentacles after death. The cœnosarc contains numerous thread-cells, somewhat similar to those of *Hydra*, but larger.

The polypary generally attains a height of about three inches, and is sometimes slender throughout, and beset with hydrophores for most of its extent, but in other cases the stem and principal branches are very thick and without hydrophores. Doubtless as the organism increases in growth the older portions become enveloped in fresh layers of cœnosarc, covering the hydrophores and forming a thick trunk as in the ordinary fascicled hydroids. The newly-formed terminal portions of the branches are compressed in a plane at right angles to that of the whole polypary.

EUCOPELLINÆ.

EUCOPELLA CAMPANULARIA, von Lendenfeld.

(Plate XIII., figs. 9-15).

This hydroid is no less remarkable for the structure of the trophosome than for the nature of the medusan gonozooid. I received portions of two gatherings, both from Bondi, but differing considerably in the form of the hydrothecæ. The hydrorhiza is remarkably broad, with a much thickened perisarc, giving off branches at right angles. The peduncles, which vary from the length of a hydrotheca to four or five times as long, are straight, and very thick and massive; but the perisarc is thinned away at the base down to its junction with the hydrorhiza, at which point the external diameter of the peduncle is but little more than that of the cavity which runs through it. The peduncle is rounded off at its summit, at which part the cœnosarcial tube is somewhat enlarged, as it is also at the base. A single spherule intervenes between the hydrotheca and the peduncle.

The hydrothecæ are remarkable among the Campanularians by their bilateral symmetry. Those of the variety which corresponds most closely with the type specimens are, as seen in their broader diameter, semi-ovate, with one of the narrower sides cut down a little lower than the opposite one, and the broader sides elevated. The margin is not everted nor toothed. There is no cavity corresponding to the external shape of the calycle, but the interior is filled up with a solid chitinous mass, leaving only a wide shallow depression at the top, and a narrow tubular passage to the base of the calycle. The hydranth is therefore not retractile, but rests on the calycle, which furnishes a slightly concave support for it. The solid part of the calycle is clear and transparent, yellowish in colour, and almost homogeneous. In the other variety the calycles are similarly solidified, but the lower part appears as if condensed and shrunken; and the transparent homogeneous structure has given place to a woody-looking

tissue, with irregular superficial ridges running from the base upwards. The two narrow sides of the calycle-margin are curved outwards, so as to form thick solid everted lips, one of which is higher than the other.

In Dr. von Lendenfeld's type specimens some of the hydrothecæ are more deeply excavated, and he states that deep-water specimens have thick hydrothecæ, while those from the harbour have thin ones. The specimens which I have described are, however, from the harbour.

CAMPANULARIIDÆ.

OBELIA GENICULATA, Linn.

Additional locality.—Middle Harbour, Port Jackson

OBELIA ANGULOSA, n.sp.

(Plate XII., fig. 3).

Hydrocaulus monosiphonic, 1-2 inches in height, usually with numerous sub-erect branches given off from the main stem; stem and branches more or less zig-zag, with a few rings or spiral turns (mostly 3-5) just above the origin of each peduncle; peduncles ringed, those on the upper portions of the hydrophyton consisting of 2-4 rings, those on the lower portions often twice the length of the calycle, usually having the central part smooth; hydrothecæ alternate, funnel-shaped, generally slightly constricted at the level of the "floor," which is some distance above the base, and situated somewhat obliquely; margin slightly everted, not toothed, somewhat uneven.

Gonothecæ urn-shaped, mostly very long and slender, with an elevated neck; peduncle with about 3-5 rings; upper part of the capsule often marked with faint, not prominent rings. Ova variable in number (often about 15), in two or three rows, or irregularly arranged. Gonozooids not observed.

Hab.—Parramatta River.

This species is found growing in tufts, the largest of which among my specimens is about $1\frac{1}{2}$ inch high. Branches are given off, sometimes profusely, from the main stem, but no secondary branchlets were to be found, though possibly such might be produced on older specimens. Each internode of the hydrocaulus springs from a point immediately below the origin of a hydrotheca-peduncle, forming a rather sharp curve upwards; and the upper part of the internode is very slightly curved outwards in the opposite direction, so that the stem or branch acquires a slightly zig-zag form. Thus instead of the peduncle of the hydrotheca being given off at an angle with the stem-internode which bears it, the peduncle is continuous with its internode in a direct line, and the next internode springs off at an angle. The hydrotheca when immature is entire, the summit being crowned with a watch-glass-shaped cap, which ultimately falls off, leaving the margin of the hydrotheca rather irregular or ragged-looking. The rings of the hydrocaulus are very distinct and regular, sometimes spiral, at other times simply annular. When the peduncles of the calyces are longer than would be equal to the width of nine or 10 rings, the central part is smooth. The gonangia are remarkable for the length they usually attain, compared with their small diameter, being often less in width than an average calycle, and more than three times its length.

OBELIA AUSTRALIS, von Lendenfeld.

(Plate XII., figs. 1-2).

Primary shoots monosiphonic, about $1-1\frac{1}{2}$ inches in height, sometimes with a few small branches, stem and branches flexuous, with a few rings or spiral turns (mostly 3-5) just above the origin of each peduncle; 8 or 10 rings usually at the base of each stem and branch; peduncles ringed, those on the upper portions of the hydrophyton consisting of about 4-10 rings, those on the lower portions longer, often with 10-20 rings, or with the central part smooth. Hydrothecæ alternate, somewhat obconical, or with the upper portion almost cylindrical; not noticeably constricted at the

level of the "floor," which is a little above the base, and situated obliquely; margin very slightly everted, not toothed, somewhat uneven.

"The gonophores have the ordinary elongate shape. . . . At the time of liberation the medusa is similar to a newly-born *O. geniculata*." (Von Lendenfeld).

Hab.—East coast of N. Zealand, Laminarian Zone.

Dr. von Lendenfeld says of this species:—"The stem of this *Obelia* is creeping, adnate to foreign bodies, to which it clings like a hydrorhiza. The stem bears hydranths on very short annulated stalks, and also a few very short branches with nearly sessile hydrothecæ. These creeping stems are short, and take their origin from a distinct hydrorhiza, which differs from the creeping stem by the much greater thickness of its perisarc, and by the numerous anastomoses which cause it to attain a reteform appearance."

I have not been able to verify this description, nor distinguish the "creeping stems" from a true hydrorhiza, but in any case the stems which bear the hydranths and short branches are not the "creeping stems," but the erect shoots. Dr. von Lendenfeld refers to this species (but apparently not with absolute certainty), an adult medusa which he found in large numbers in Port Jackson. The tentacles are said to be from 30 to 40, and the umbrella always in a reverted position. This is not the case with the young medusæ which were obtained with the trophosome.*

O. australis is somewhat coarser and more rigid than *O. angulosa*. It may be distinguished from that species by the internodes of the stem, which are not abruptly curved outwards at their origin, but are more or less curved alternately in opposite directions throughout their whole length, so that the stem is flexuous. The hydrothecæ are less conical than those of *O. angulosa*, without the distinct constriction at the level of the floor, which is also nearer the base of the cell, and rather more oblique.

*On p. 920, Vol. IX., Dr. von Lendenfeld says, "I have described this species from the polyp-colonies and the young larvæ which I obtained in Port Jackson." In the original description, however, the only locality mentioned is the East coast of New Zealand.

CAMPANULARIA CALICULATA, Hincks.

(Plate XIII., figs. 1-3).

Two gatherings of this species have been obtained from Port Jackson, in one of which the calyces are for the most part wholly without the thickened wall which usually characterizes the species; occasionally however they conform to the type. In the other specimens, the calyces agree pretty closely with those figured by Mr. Hincks, and vary to about the same extent. The peduncles are exceedingly variable in length, sometimes being 16-18 times the length of the calycle. They may be closely undulated throughout, or almost smooth, the latter condition occurring principally in the longer peduncles. The gonangia contain two sporosacs, and are borne in extraordinary profusion, their number often greatly exceeding that of the hydrothecæ.

CAMPANULARIA CALICULATA, *var. makrogona*, von Lendenfeld.

(Plate XIII., figs. 4-8).

In this variety the hydrotheca-wall is thickened throughout, but more particularly at the base, and at the upper portion, where the chitinous substance forms an external band encircling the upper $\frac{1}{2}$ or $\frac{1}{3}$ of the calycle, very thick in the centre, and gradually thinned away above and below. In most of the hydrothecæ the cavity is exactly cylindrical, with a flat floor, but in some of them the internal diameter slightly diminishes downward. The margin is somewhat everted, and often becomes doubled or trebled by successive circles of growth. The peduncles are stout and usually very strongly undulated.

I am not aware whether the very large gonangia characteristic of this variety are always associated with the peculiar form of hydrothecæ which I have described; if so, it may be questioned whether there is not sufficient ground for separating this form as a distinct species.

CAMPANULARIA (?) SPINULOSA, n.sp.

(Plate XII., figs. 5-7).

Hydrorhiza slender, climbing; hydrocaulus about $\frac{1}{2}$ inch high, slender, unbranched or with numerous sub-erect branches; stem and branches nearly straight, with a few rings or spiral turns (mostly 4-6) just above the origin of each peduncle, 6-12 rings usually at the base of each stem or branch; peducles ringed, those on the upper parts of the hydrophyton consisting of about 5-6 rings, those on the lower portions often with 8-10. Hydrothecæ alternate, sub-cylindrical in their upper half, tapering below, slightly constricted at the "floor," which is a little above the base, and somewhat oblique; margin armed with a number of minute slender compressed spines (usually 20-24) arranged in pairs, the margin very slightly sinuated between the two spines of a pair, more deeply sinuated (almost semi-circularly) between the pairs; hydrotheca marked with faint longitudinal lines, one between every two pairs of spines.

Gonosome unknown.

Hab.—Port Jackson, on a Tubularia.

In the form of the hydrothecæ, and the arrangement of their marginal teeth, this species is similar to a hydroid described by Clarke under the name of *Obelia bidentata*,* but that species is polysiphonic and grows to the height of six inches, while the specimens of *C. spinulosa*, which I have examined, are of delicate growth and not more than half an inch in height. It is possible, though perhaps not probable, that the present species is a young form of *O. (?) bidentata*; at present it may be provisionally regarded as distinct. Most of the shoots exhibit the rudiment of a polysiphonic structure, consisting of a delicate stolon which originates from an aperture formed at the outer side of the base of the most proximal peduncle, and grows downward along the

* Descriptions of new and rare species of hydroids from the New England coast. (Transactions of the Connecticut Academy of Arts and Sciences, Vol. III., Part I.)

original stem. When it reaches the object on which the zoophyte is growing it becomes attached thereto, and assuming the character of the hydrorhiza, gives off fresh shoots. In nearly all my specimens the downward growth of the supplemental tube was arrested by the death of the organism before it could reach the base of the stem, leaving it with an obliquely truncated extremity.

CAMPANULARIA (?) SERRULATA, n.sp.

(Plate XII., fig. 4).

Hydrorhiza slender, climbing; hydrothecæ borne on long peduncles, which spring either directly from the hydrorhiza or from the side of other peduncles; peduncles slender, with about 8-16 rings at the base and a less number (mostly 2 or 3) at the summit, smooth throughout the rest of their length. Hydrothecæ large, campanulate, constricted at the "floor," which is raised above the base so as to enclose a nearly cylindrical cavity; margin not expanding, armed with about 10-14 rather large, triangular, pointed teeth.

Gonosome unknown.

Hab.—Port Jackson, on a Tubularia.

This is a delicate species, with no proper stem, but the primary peduncles generally give origin to secondary ones exactly resembling them, the habit in this respect being similar to that of *C. marginata*, a species otherwise very different to the present. The rings of the peduncles are distinct and regular, as in *C. spinulosa*. The specimens were less than half an inch in height.

CAMPANULARIA COSTATA, Bale.

Near Peel Island, Moreton Bay, parasitic on *Pasythea hexodon*. (Mr. J. D. Ogilby).

The aperture is more or less oblique in most of the specimens. Perhaps this species might best be placed in the genus *Laföea*.

CAMPANULARIA MARGINATA, Bale.

Bondi ; Coogee (plentiful), (Mr. T. Whitelegge).

I have mentioned in the "Catalogue" that some of the hydrothecæ of this species have the remains of an operculum visible, but in these specimens the structure alluded to is not present. It is a very delicate membrane, and in the few cases where I have met with it was incomplete. It may probably be a temporary structure like that which covers the immature hydrothecæ of various species of Obelia.

LAFOEIDÆ.

LAFOEA SCANDENS, n.sp.

(Plate XIII., figs. 16-19).

Hydrophyton parasitic on other hydroids ; hydrorhiza slender ; hydrothecæ springing directly from the hydrorhiza, tubular, straight or slightly curved, rounded below to the level of the "floor," basal portion short, contracted, pedicle very short ; aperture simple, margin very slightly everted, often double or triple.

Gonangia about double the length and diameter of the hydrothecæ, tapering downwards in the lower half ; with more or less distinct transverse undulations ; margin with three or four shallow emarginations ; summit of the blastostyle forming a trumpet-shaped expansion ; gonophores two, both on the same side of the blastostyle.

Hab.—Port Stephens ; Port Jackson ; mostly on *Sertularella divaricata*, var. *sub-dichotoma*.

The specimens of *Sertularella divaricata* from Port Stephens were quite overrun by this species, its hydrothecæ in some parts equalling or even exceeding in number those of the *Sertularella*. So far as I am aware, it is the first species of *Laföea* in which the gonosome has been observed. The gonothecæ were fairly

plentiful, and in various stages of development; those which were entire und unopened contained a slender blastostyle bearing two gonophores. The summit of the blastostyle is trumpet-shaped and apparently open, but no tentacles are present. The terminal portion appears to fall off before the maturity of the second gonophore; at least it was absent from those capsules from which the primary gonophore had been extruded. The gonophore seemed to contain three or four large ova grouped above a stout spadix, but the specimens were not sufficiently well preserved to place the structure beyond doubt. The aperture of the ripe gonotheca, with its three or four emarginations and corresponding opercular divisions, strongly resembles the aperture of the hydrothecæ in some species of *Sertularella*.

HALECIIDÆ.

HALECIUM GRACILE, n.sp.

(Plate XIV., figs. 1-3).

Hydrophyton slender, monosiphonic, attaining a height of about $\frac{3}{4}$ inch; hydrorhiza climbing over other hydroids; branches somewhat straggling, variable in length, stem and branches slightly flexuous, divided into moderately long internodes, by twisted oblique joints which slope alternately in opposite directions, each internode bearing a calycle close to its upper extremity. Calycles alternate, varying from almost tubular to funnel-shaped, and often with other calycles springing from within them; margin expanding, strongly everted; basal part of the calycle sometimes ringed.

Gonothecæ,—female, large, ovate, compressed, sporosac decidedly narrower than the capsule, with a space at the upper part not occupied by ova:—male smaller, club-shaped in outline.

Hab.—Port Stephens, on an *Aglaophenia*; Port Jackson, on a *Tubularia*.

This species differs from most others in being slender and monosiphonic. Each internode gives off primarily a single calycle,

and the branches originate at the sides of these calyces. When the soft matter is cleaned away there is usually visible a circle of puncta indicating the position of the base of the hydranth, and when a new calycle is formed within an old one it originates from this part, which is but a short distance below the margin. The base of the hydranth is usually flattened, and is united by a very slender isthmus to an offshoot of the cœnosarc which occupies the centre of the lower part of the hydrophore. Sometimes the branches are all short, and somewhat pinnately arranged, but in other specimens they are larger, occasionally equalling the stem in length.

HALECIUM PARVULUM, n.sp.

(Plate XIV., figs 4-5).

Hydrophyton about $\frac{1}{2}$ to $\frac{3}{4}$ inch high, branches ascending, stem and lower branches fascicled, stem and branches flexuous in the upper portions, divided into rather short internodes by twisted oblique joints, which slope alternately in opposite directions, each internode bearing a calycle close to its upper extremity. Calyces alternate, sub-tubular, often with other calyces springing from within them; margin expanding, strongly everted, basal part of the calycle sometimes ringed.

Gonotheca,—female, large, ovate, compressed, with a large concave notch at the summit, sporosac similar in outline to the capsule, and nearly filling it, ova completely occupying the interior of the sporosac:—male, not observed.

Hab—Bondi Bay.

In the form and arrangement of the calyces this species differs little, if at all, from *H. gracile*, but may be distinguished from that species by the compound stem and shorter internodes, as well as by the difference in the gonosome. The specimens were growing on a small sponge, and a very intimate union existed between the sponge and the hydroid, the former having grown for some distance round the basal portions of the Halecium, and the sponge-fibres being closely and firmly adherent to the latter in all

directions. Mr. Whitelegge informs me that the specimens in the Museum are all similarly attached to the same species of sponge; it is therefore probable that the association is a constant characteristic.

SERTULARIIDÆ.

SERTULARELLA DIVARICATA, *var. sub-dichotoma*, n. var.

(Plate XVI., figs. 3-4).

Hydrocaulus about 6 inches in height, straggling, ramuli similar to the stem, given off irregularly, but in the same plane; thicker portions of the hydrocaulus sometimes supporting more than one hydrotheca on an internode. Hydrothecæ tubular, adnate most of their height, free part slightly bent outwards; aperture with three teeth, the superior somewhat recurved.

Gonothecæ large, obovate, strongly annulated (9-10 rings), orifice very small, infundibulate, mostly excentric.

Hab.—Port Jackson.

The trophosome differs from that of the typical *S. divaricata* only in its habit, the ramuli being given off quite irregularly and at long intervals, while those of the type are borne, with some exceptions, below every third hydrothecæ on each side of the stem. The gonothecæ differ from those of the type simply in the small size of the orifice, which is like that commonly found in the Bass' Straits form of *S. Johnstoni*.

SERTULARELLA DIVARICATA, *var. dubia*, n. var.

(Plate XVI., figs. 1-2).

Hydrocaulus 1-2 inches high, ramuli similar to the stem, given off irregularly but in the same plane, thicker portions of the hydrocaulus sometimes supporting more than one hydrotheca on an internode. Hydrothecæ tubular, adnate most of their height, free part slightly bent outwards, aperture with three teeth, the superior somewhat recurved.

Gonothecæ large, obovate, strongly annulated, (10-12 rings), orifice rather wide, infundibulate, mostly excentric.

Hab.—Bondi Bay.

This form might with almost equal propriety be assigned either to *S. divaricata* or to the southern Australian *S. Johnstoni* (if indeed it be not, as appears likely, one of a series of transition forms uniting the two). In the bushy habit and the comparatively short internodes it rather resembles *S. Johnstoni*, but its hydrothecæ are more like those of *S. divaricata*, being adnate most of their length, and only slightly projecting forward. The peristome often consists of several successive growths. The gonothecæ are a little smaller than those of the type, with closer and more numerous rings; the aperture is precisely similar. The polypary is much shorter and more bushy than that of the variety *sub-dichotoma*, but the pinnæ or ramuli, as in that form, are given off at irregular intervals, so that the pinnate habit is lost.

SERTULARELLA LONGITHECA, n.sp.

(Plate XVI., figs. 5-6).

Hydrocaulus slightly branched, divided by oblique joints into internodes which bear one or occasionally two hydrothecæ. Hydrothecæ adnate from $\frac{1}{3}$ to $\frac{1}{2}$ of their length, long, narrow, tubular, smooth, curved outwards, springing from the sides of the hydrocaulus or partly from the front; aperture not contracted, with three large teeth, one superior and two lateral.

Gonothecæ rather large, without annulations, somewhat widened laterally, with a shoulder at each side of the aperture; aperture small, tubular, not expanding.

Hab.—Port Denison.

The only specimen I have seen was $2\frac{1}{2}$ inches high, and consisted of a monosiphonic stem with five or six simple lateral branches. The hydrothecæ are toothed like those of the *S. Johnstoni* group, but are nearly double as long in proportion to their diameter, while

the gonangia are of a totally distinct type. Only one of the latter was present, which was slightly distorted, so that its exact form was rather doubtful, but it appeared to have two lateral wings terminating upwards in angles at each side of the aperture.

SERTULARELLA MICROGONA, von Lendenfeld.

(Plate XVI., fig. 8).

Hydrocaulus simple, about $\frac{1}{8}$ inch in height, composed of long, slender internodes which are abbreviated above close to the hydrothecæ, and are undulated somewhat spirally in their lower portions. Hydrothecæ barrel-shaped, rather slender, somewhat contracted towards the aperture, with about three transverse rugæ; adnate $\frac{1}{2}$ of their height or somewhat more, directed outwards and but slightly forwards; aperture with four teeth and a four-sided operculum; three internal compressed vertical teeth, two of which are within the two upper emarginations of the border, and the third opposite the inferior marginal tooth.

Gonothecæ?

Hab.—Port Phillip.

This species is a close ally of the *S. tenella* of Hincks, and is very slender throughout. The portions of the internodes below the hydrothecæ are slightly waved, long, and tubular, often being fully double the length of the hydrotheca. The internal teeth are three in number, and are arranged precisely as in *S. indivisa*; but as *S. microgona* has four marginal teeth, the internal ones do not alternate regularly with them, the lower one being opposite a marginal tooth, while the others are between the three upper marginal teeth. A close examination of specimens of *S. polyzonias* from Port Phillip shows that a similar arrangement exists in that species, though the internal teeth are so delicate and transparent that they are easily overlooked.

Dr. von Lendenfeld says that the gonangia of *S. microgona* are without rings, but his outline figure shows them transversely wrinkled.

SERTULARELLA VARIABILIS, n.sp.

(Plate XV., figs. 5-9).

Hydrocaulus simple or pinnate, pinnæ when present alternate, given off just below each hydrotheca on the stem; stem and pinnæ divided by twisted joints into internodes, each bearing a hydrotheca on its upper part. Hydrothecæ adnate from $\frac{1}{3}$ to $\frac{1}{2}$ their height, divergent, both series directed towards the front or all nearly in the same plane, with several more or less distinct transverse rugæ, contracted near the aperture and swollen below; aperture with three marginal teeth, one superior and two lateral, also with three internal compressed vertical teeth alternate with those of the margin, or sometimes with three teeth within the lowest side and one within each of the other two sides.

Gonothecæ ovate, with transverse undulations which vary greatly in number and distinctness, and are often absent from the proximal part; summit tubular, with from two to six teeth, and a small circular aperture.

Hab.—Bondi; Coogee.

With some hesitation, I include under the name of *S. variabilis* a series of forms allied to (and partly intermediate between) the *S. indivisa* and *S. solidula* of the southern coast. The form which may be regarded as the type differs from *S. indivisa* mainly in having the internodes and hydrothecæ stouter and comparatively shorter, so that for the most part each hydrotheca is nearly or quite in contact with the lower part of the next internode above, while in *S. indivisa* the internodes are slender and elongated, with the joints consisting usually of double oblique constrictions, so that the hydrothecæ are more widely separated. The hydrothecæ in the present form are also larger, and both series are commonly, but not invariably, directed towards the front, instead of lying in the same plane. The other principal type represented in the collection seems more apt to assume the pinnate form, and would not be suspected of any very close affinity with the first variety if it were not for the occurrence of intermediate forms. The

hydrothecæ are smooth, or nearly so, and the constriction below the aperture is absent or very slight on the outer side, while it is strongly marked on the inner, so that the terminal portion of the hydrotheca has the aspect of being recurved towards the hydrocaulus, an appearance which is strengthened by the outer marginal tooth being longer than the other two. The hydrothecæ in this variety are proportionately longer than in the others. Both series are strongly directed forwards, and when the pinnate form is fully developed the hydrophyton bears a remarkable similarity to that of *S. neglecta*, from which species it may be distinguished by the pinnæ being mostly alternate instead of sub-alternate, and being given off below each hydrotheca on the pinnate part of the stem instead of below every second one on each side, by the much shorter marginal teeth of the hydrotheca, and by the internal teeth, also by the different gonangia.

While it must be admitted that the arrangement of these varieties under one species is not perfectly satisfactory, they appear to run into each other by so many intermediate forms that I have so far failed to find any distinct line of demarcation between them. It is not improbable that *S. indivisa* will have to be referred to the same species, and perhaps *S. solidula*. All the varieties possess teeth within the hydrotheca-margin, one within each of the two upper sides, and either one or three within the lower side. The hydrotheca often has two minute rod-like thickenings of the perisarc about midway down, on opposite sides.

SERTULARELLA SOLIDULA, Bale.

(Plate XV., figs. 3-4).

A specimen from Bondi, with the ends of the hydrothecæ curved outwards rather more than those of the type form.

SERTULARELLA CYLINDRICA, n.sp.

(Plate XVI., fig. 7).

Hydrocaulus about half an inch in height, simple or slightly branched, divided by oblique joints into internodes of moderate

length, each bearing a hydrotheca on its upper part. Hydrothecæ adnate nearly half their height, large, stout, cylindrical, smooth, usually somewhat rounded at the base, curved outwards; aperture looking outwards and upwards, not contracted, margin entire, very slightly everted, peristome often double or triple.

Gonothecæ unknown.

Hab.—Port Jackson.

A single specimen occurred among a mass of *S. divaricata* var. *sub-dichotoma*. It is quite unlike any Australian species hitherto known, and may be readily distinguished by the uncontracted entire margins of the hydrothecæ. The latter somewhat resemble those of *Sertularia patula*, Busk, but are free for a much greater portion of their length. I could not satisfy myself of the existence of an operculum.

SYNTHECIUM, Allman.

The genus *Synthecium* differs from *Sertularia* in the gonosome, the pedicels of the gonangia having their origin within certain of the hydrothecæ, where they take the place of the hydranths. The *Sertularia orthogonia* of Busk, the gonosome of which has hitherto been unknown, belongs to this genus, so also doubtless does *S. patula*. The *Dynamena tubulosa*, Heller (*Zoophyten und Echinodermen des Adriatischen Meeres*), is evidently a *Synthecium*. Professor Allman has remarked that Heller's figure shows a gonangium springing directly from the stem, but I have no doubt that what Heller has figured is a parasitic hydroid like *Campanularia* (?) *costata*.

The five known species all agree in having opposite pinnæ, which spring from the stem at a point where there are no hydrothecæ, also in having the hydrothecæ opposite, tubular, curved outwards, and with the margin entire. Professor Allman's two species (which are probably reducible to one) have the hydrothecæ very much slenderer in proportion to the length than *S. orthogonia* and *S. patula* (which may perhaps be also united). Heller's species is likewise very similar to *S. patula*, and may be identical.

SYNTHECIUM ORTHOGONIA, Busk.

(*Sertularia orthogonia*, Busk, "Voyage of the Rattlesnake.")

(Plate XVII., figs. 1-5).

Hydrocaulus pinnate, attaining a height of about three inches ; internodes of the stem long, each bearing a pair of pinnæ at the summit, and one or two pairs of hydrothecæ below (except the lower internodes, which commonly bear a pair of pinnæ only) ; pinnæ distant, opposite, widely divergent, divided into internodes, each with one pair of hydrothecæ. Hydrothecæ opposite, not in contact but often approximate in front, tubular, adnate most of their height, free part curved outwards more or less abruptly and often produced horizontally ; aperture circular, vertical or directed slightly upwards, margin entire, very slightly everted, usually more or less marked with lines of growth.

Gonothecæ large, elongated, somewhat compressed in a plane vertical to that of the hydrocaulus, with about 8-10 distinct transverse undulations on the broader sides ; aperture terminal, very small, without thickened border or distinct operculum.

Hab.—Off Ball's Head, Port Jackson.

I have no doubt that this is the *Sertularia orthogonia* of Busk, though the free part of the hydrothecæ is rarely produced outward to so great an extent as in the type form. This abbreviation of the hydrotheca tends to weaken the distinction between this species and *S. patula*, nevertheless it is still open to doubt whether they should be united. The hydrothecæ of *S. orthogonia* are longer than those of *S. patula*, and the adnate portion is decidedly more erect, while the free part is curved outwards much more abruptly, and the aperture is nearly or quite vertical, even when the terminal portion of the hydrotheca is somewhat ascending. The margin is not noticeably sinuated at the sides, and is marked with lines of growth even in the terminal hydrothecæ. In *S. patula* the hydrothecæ are smaller and are not abruptly flexed, but are gradually curved outwards for most of their length, while

at the same time the free portion is not nearly so divergent as is generally the case with *S. orthogonia*. The aperture is at right angles to the terminal part of the hydrotheca, and the margin is slightly sinuated at the two sides, while it is more everted than in *S. orthogonia*, and lines of growth seem rare. It is true that in each species calyces may be found which are somewhat intermediate, but there is no difficulty in distinguishing between such specimens as I have met with; I therefore hesitate to unite them without further evidence.

The gonothecæ are large and compressed, so that in an ordinary view of the polypary they are seen edgewise, the transverse undulations then appearing very distinct. These undulations, however, do not run round the gonotheca, but are confined to the two broader sides, and gradually smoothed away towards the narrower sides, so that if the gonotheca be viewed in its broader aspect its outline appears smooth or nearly so. In Professor Allman's two species the undulations are continued till they meet two zig-zag median lines which run down opposite sides of the gonotheca; the gonothecæ also are much shorter than those of *S. orthogonia*, and apparently not so compressed. One fragment of *S. orthogonia*, found among the rest, has gonothecæ not unlike those of Allman's species in size and shape, and showing chitinous ridges in the front view, which however do not run straight across to meet a mesial line, but form an entirely irregular network. I am not aware of the signification of these peculiar gonangia, so different from the ordinary ones, but they may be due to an accidental deformity.

The hydrothecæ of *S. orthogonia* are usually directed outwards, but in some specimens they are also turned towards the front, the opposite hydrothecæ being almost in contact in the front of the polypidom.

SERTULARIA GENICULATA, n.sp.

(Plate XVII., figs. 6-11).

Hydrocaulus simple, minute, with a pair of hydrothecæ on each internode, joints slender. Hydrothecæ opposite, in contact with

each other in front, separated behind, the outer side of each forming a strongly salient angle below the aperture; the body of the hydrotheca projecting forward from the internode, the distal portion twisted upwards; aperture nearly vertical, margin without distinct teeth.

Gonothecæ rather small, ovate, with 5 or 6 strong transverse costæ; one only on a shoot, springing from the basal part of the proximal internode.

This species, which I found running over the surface of a *Flustra*, is very small, none of the shoots which I observed bearing more than three pairs of hydrothecæ, the peculiar twisted form of which is very distinctive. The most nearly allied species is perhaps the *Dynamena conferta* of Kirchenpauer.

SERTULARIA COMPLEXA, S. F. Clarke.

(Plate XVIII., figs. 1-4).

Hydrorhiza stout, shoots simple, about half an inch in height, with a pair of hydrothecæ on each internode. Hydrothecæ opposite, in contact with each other in front, separated behind, long, tubular, free for about $\frac{1}{3}$ of their length, upper portion curved outward, the hydrotheca-wall produced downwards into two points below the inner side of the base; aperture vertical, margin with two lateral teeth or angular lobes.

Gonothecæ borne principally on the hydrorhiza, small, subglobular, truncate at the summit, with 6-8 distinct annulations; aperture operculate, margin not elevated, a few small irregular teeth within the margin.

Hab.—Bondi Bay: Yucatan, America (Clarke).

This slender species, which is found profusely over-running leaves of *Zostera* or *Cymodocea*, very nearly resembles *S. tuba* in the form of its hydrothecæ, but differs from that species in its simple habit and in the form of the gonothecæ. The two spines which in *S. complexa* project downwards from the base of the hydrotheca into the cavity of the hydrocaulus are also distinctive, but are

often wanting in some of the calyces. There is a conspicuous oblique joint at the base of the lowest internode of each shoot.

Mr. Clarke's figure and description* agree with our specimens, except that he represents the teeth of the hydrotheca-margin for the most part above and below the aperture rather than at the sides ; but one or two of his figures approximate to the present form in this respect, and the other details being precisely similar, I have little doubt that the identification is correct. The gonothecæ were not present in Mr. Clarke's specimens.

SERTULARIA ELONGATA, Lamx.

Coogee.—A small specimen with some of the cauline internodes bearing only a pair of hydrothecæ and no pinnæ.

PASYTHEA QUADRIDENTATA, Ellis and Solander.

(Plate XIV., figs. 6-7).

Coogee ; Bondi.

Of these specimens, that from Coogee most resembles the type, but is distinguished by the internodes being less elongated, so that the sets of hydrothecæ are close together. The Bondi specimens are peculiar, a considerable proportion of the internodes bearing only a single pair of calyces each ; indeed some of the shoots are so arranged throughout, and thus differ in no respect from a typical *Sertularia*. The apertures of the calyces are directed more to the front than in the type, and have blunter teeth, and the hydrothecæ generally, when not united in sets, strongly resemble those of some forms of *S. australis* and *S. loculosa* ; and as in the latter species the joints between the internodes are in some cases simple and inconspicuous, while in others the upper internode is produced downwards to a point, and the lower is similarly produced upward behind it.

I observed a single gonotheca, which was sub-globular, with about four not very prominent transverse annulations, and a large aperture with an elevated neck and an operculum.

*Report on the Hydroida collected during the exploration of the Gulf Stream and Gulf of Mexico, by Alexander Agassiz 1877-78. (Bull. Mus. Comp. Zool., Cambridge U.S., Vol. V No. 10)

PASYTHEA HEXODON, Busk.

Plate XIV., figs. 8-9.

Hydrocaulus 1-2 inches in height, sub-dichotomously branched, with a hydrotheca in each axil; internodes tubular, long and slender, bearing the sets of hydrothecæ near their upper extremities, joints mostly inconspicuous. Hydrothecæ tubular, usually from six to ten in a set, often unequally arranged on the two sides of the internode, each one adnate to that next above it by a considerable part of its dorsal surface, and adnate to the hydrocaulus by its basal portion; the two series strongly divergent, the lower ones of a set more so than the upper, especially in their terminal portions; an angular ridge running down each side of the cell; aperture very oblique (sloped off from below), margin somewhat expanding at the upper part of each side, with two indistinct lateral lobes.

Hab.—Near Peel Island, Moreton Bay (Mr. J. D. Ogilby).

This species has not hitherto been recorded since Mr. Busk described it in the account of the "Voyage of the Rattlesnake." Mr. Busk says that there are six hydrothecæ in a set, but in these specimens there are commonly eight to ten, and sometimes more. While *P. quadridentata* is closely allied to the Sertulariæ, having its calyces in distinct pairs, with the two calyces of each pair in contact in front, *P. hexodon*, on the other hand, approximates to the Thuiariæ, the hydrothecæ being crowded and overlapping each other, as is so often the case in that genus, while there is no regularity in the arrangement of the two series with regard to each other. In most cases those on the two sides of the hydrocaulus are opposite to each other, but it is quite common to find them alternate, and the set frequently contains more on one side than the other, as three to four, or four to six. The ramification is not perfectly dichotomous, but branches are given off irregularly in the same plane, the axial hydrothecæ being adnate for most of their length to the principal shoot.

THUIARIA SINUOSA, n.sp.

(Plate XVIII., figs. 9-10).

Hydrocaulus pinnate, stem indistinctly and irregularly jointed, fascicled below; pinnae alternate, with few or no joints, three hydrothecae between every two on the same side of the stem. Hydrothecae opposite to alternate on the pinnae, alternate on the stem, a rather wide space between the two series; long, sub-conical, each one curved first slightly outwards and then upwards, the extreme summit again curved outwards, adnate in their lower half to the hydrocaulus, and in their upper half to the next hydrotheca above, which they overlap; a conspicuous triangular area below the base of each; aperture small, semi-circular, looking directly outwards.

Gonothecae borne in rows along the front of the pinnae, obovate, with distinct transverse annulations, aperture large, margin elevated; a few long crooked teeth or spines inside the neck.

Hab.—Port Molle.

I received a small piece taken from a specimen in the Museum, which, Mr. Whitelegge informs me, is about two inches high, and incomplete. The species is allied in some respects to *T. fenestrata*, but the peculiar form and arrangement of the calyces distinguish it from all other known species. The stem has few joints and those indistinct; the shortest internode has two hydrothecae on the same side as the pinna (which springs from between them and is in contact with both), and a single one on the opposite side. The longer internodes are equivalent to two or more of these with the joints obliterated. The shorter pinnae in my specimen were without joints, the longer ones had a single joint not far from the end. There is a thinning away of the perisarc over the triangular spaces below the hydrothecae, very much as in *T. fenestrata*.

THUIARIA QUADRIDENS, Bale.

A slender variety, from near Peel Island, Moreton Bay.

THUIARIA FENESTRATA, Bale.

Moreton Bay, Queensland ; Port Phillip Heads, Victoria.

This species must be added to the list of those which occur on both the southern and north-eastern coasts, as I have received from Dr. MacGillivray a fine specimen obtained at Port Phillip Heads. The shoots are very numerous, and form a densely matted tuft ; the two series of calyces are rather closer together than in other specimens which I have seen. Gonothecæ were present, and differ from the figure and description given in the "Catalogue," the border being plain. In representing the gonotheca as having four emarginations of the border, I followed a drawing of Mr. Busk's taken from a hydroid in the Gay herbarium, labelled *Salacia tetracyttara*, and identical with his *Sertularia crisioides* (*T. fenestrata*). The present specimens however, exhibit no trace of any toothed or emarginate state of the border.

PLUMULARIIDÆ.

ELEUTHEROPLEA.

AZYGOPLON, n.gen.

Hydrophyton pinnate, supracalcine sarcothecæ absent, mesial anterior sarcotheca not adnate to the hydrotheca, nor in contact with it.

Gonosome without phylactocarpal appendages.

This genus (of somewhat doubtful position) is proposed for the reception of the species which I originally described under the name of *Plumularia producta*, and is characterised mainly by the absence of supracalcine sarcothecæ, a feature which it exhibits in common with the genera *Halicornopsis* (*Azygoplon*, Allman) and *Diplocheilus*. The latter genus, however, is said to be distinguished by the presence of an external calcine envelope, and the former has the anterior sarcothecæ adnate to the front of the hydrothecæ, as in other *Statopleæ* ; while in *Azygoplon* the

anterior sarcothecæ are quite disconnected from the hydrothecæ, and bear a considerable resemblance to the corresponding organs in some of the Eleutheroplea. To that section, therefore, I would assign the new genus, more especially as the only Plumularian which is known to share with *A. productum* the peculiarity of possessing decumbent adnate gonothecæ (namely, *Plumularia filicaulis*) is an undoubted Eleutheroplean.

The generic name *Azygoplus* has already been applied by Professor Allman to another hydroid, for which, however, the name *Halicornopsis* had priority.

AZYGOPLOUS PRODUCTUS (= *Plumularia producta*, Bale).

(Plate XIX., figs. 1-5).

From an examination of specimens obtained by Mr. Whitelegge at Coogee, I am able to give a more complete account of this species than has hitherto been possible, the gonangia in particular, not having been previously observed. These are given off from the hydrorhiza, and are attached to the supporting substance by the flat under side, like those of *Plumularia filicaulis* and the whole hydrosoma of *Lincolaria*. The upper side is convex, and furnished with transverse undulations, which vary in distinctness, but do not appear to be ever very strongly marked; they are usually indistinguishable when seen from above in a fluid medium, but are readily seen by reflected light when dry. The gonothecæ are large in size, of an irregularly ovate outline, and there is at first no trace of an aperture, but after a certain time a rather large circular area of the capsule close to the distal end appears as if bulged in, forming a slight concavity bounded by a circular ridge at which separation ultimately takes place.

I have not alluded to the cauline sarcothecæ in former descriptions of this species, as I failed to see them satisfactorily in my first specimens, owing to their rudimentary condition and the wrinkling of the delicate perisarc; but I have been able to make them out in other cases, and particularly in Mr. Whitelegge's specimens. There are usually two at the base of each pinna, one

of which, situated in the axil, is larger than the other, and both are simply conical projections. In a specimen from Queenscliff the axillary sarcothecæ have a distinct incomplete partition just within the aperture, but this bithalamic condition is absent from the others. In several specimens I could only distinguish the axial sarcothecæ. Besides the sarcothecæ already mentioned there is sometimes one at the summit of each stem-internode in front.

The mesial anterior sarcothecæ consist, in their perfect form, of a lower chamber, or protuberance of the pinna, terminating in a shallow concave or saucer-shaped receptacle facing the hydrotheca, and emarginate below, where the rim terminates at each side by becoming united to the pinna. In Mr. Whitelegge's specimens however, the wall of the upper loculus is usually cut away on both sides so that there remains only a scoop-shaped projection directed towards the hydrotheca from the top of the lower chamber, and presenting, when seen in front view, a more or less rectangular form. Some of the sarcothecæ however approximate to the ordinary form, while different varieties of the species present various intermediate forms between the extremes above-mentioned.

There is a striking resemblance between this species and the *Diplocheilus mirabilis* of Professor Allman's "Challenger" Report, so far as the more important structural features are concerned. Both species agree in the absence of the supracalycine nematophores, and in having the anterior nematophore unattached to the calycle, and even the peculiar form of the nematophores appears almost alike in both species, except that those of *A. productum* are more erect. The only distinction of more than specific value is the presence in *D. mirabilis* of an external envelope surrounding the upper part of the hydrotheca, and from analogy with several other species it seems extremely probable that the external envelope is really the outer surface of a *thickening* of the calycle, and not a distinct structure. Such thickenings of the perisarc are by no means rare, familiar examples being the stem-internodes of *Obelia geniculata* and the calycle-wall of *Campanularia caliculata*, while in *Eucopella* we have an extreme case, the hydrotheca being almost entirely filled by a

solid mass of chitinous substance. Sometimes this substance is marked by striæ indicating variations of density, and proving its solidity ; but in some cases, as in *C. caliculata*, it is homogeneous, so that the hydrotheca resembles an inner cup with an outer calycine envelope, the illusion being, as Mr. Hincks says, so complete that he at first described this as the actual structure. The hydrothecæ of *Plumularia delicatula* are considerably thickened internally at the same part where in *D. mirabilis* the calycine envelope is said to exist, and specimens of *P. setaceoides* in the present collection have an external thickening in front still more extensive. *A. productum* itself is frequently thickened in the same fashion, if not to the same extent. That this should be the case with some specimens and not with others is quite conformable to experience ; for example, in some forms of *C. caliculata* there is no noticeable thickening of the calycle, and Dr. von Lendenfeld finds a similar variation in *Eucopella*. When the chitinous mass is homogeneous in appearance it appears to be very incompletely solidified, so that drying it, or immersing it in a dense medium, such as Canada balsam, causes it immediately to shrink.

While it would be impossible to decide absolutely, without examination, that the structure of *D. mirabilis* is as I have suggested, the analogy of the other species mentioned is so strong as to render such a conclusion highly probable, in which case *D. mirabilis* and *A. productum* would be clearly referable to the same genus. As regards specific characters, *A. productum* differs from *D. mirabilis* in its much smaller size, in the form of the hydrotheca, in the presence of a distinct anterior intrathecal ridge, and in some minor features.

PLUMULARIA CAMPANULA, Busk.

(= *P. laxa*, Allman ; *P. Torresia*, von Lendenfeld).

(Plate XX., figs. 1-6).

The specimens from the Museum, as well as some from Port Phillip Heads, sent me by Mr. J. B. Wilson, include the gonothecæ, which I have hitherto been able to describe very imperfectly,

owing to my former specimens having been all dried, and more or less shrivelled. The female capsules are nearly three times the length of the hydrothecæ, pear-shaped, slightly flattened above, and tapering off gradually below, and are provided with a pair of sarcothecæ near the base, one on each side. When ripe they open at the summit by a circular operculum, the border of the orifice being very slightly thickened. Between the short pedicle and the capsule itself there is a distinct sub-globular segment. In some specimens the capsules are broader towards the summit than in others. The male gonothecæ are considerably smaller, ovate, not flattened at the summit, and have only a single sarcotheca. Male and female gonothecæ are borne on the same colony.

Many of the pinnæ of *P. campanula* bear secondary hydrocladia, but the character is not constant. A single pinna may bear two or three of these offshoots arranged alternately, and occasionally tertiary hydrocladia are produced.

The hydrothecal internodes vary considerably in length in different specimens, or even in the same colony, the hydrothecæ varying accordingly in their distance apart, so that the superior median sarcotheca, which is normally placed some distance above the hydrotheca, may be situated almost behind the free margin.

P. campanula differs from all other species known to me (except *P. rubra*) in the short stout lateral sarcothecæ, which, moreover, are not freely moveable.

The type specimens prove that *P. Torresia* is identical with *P. campanula*. Dr. von Lendenfeld represents the calycle-margin as somewhat incurved, and with a double tooth at the back, but as there is no trace of these peculiarities in his types, they are probably due to distortion in mounting.

Dr. von Lendenfeld's specimens, from Torres Straits, agree precisely with those collected by Mr. Wilson at Port Phillip Heads; others from Broughton Islands have the female gonotheca somewhat narrower.

PLUMULARIA RUBRA, von Lendenfeld.

(Plate XX., figs. 1-6).

Hydrocaulus about three inches high, stems clustered, monosiphonic, unbranched, bearing hydrothecæ as well as pinnæ. Pinnæ alternate, distant, one on each internode, often supporting secondary hydrocladia, joints oblique, a hydrotheca on each internode, except the first on each pinna. Hydrothecæ borne at the lower ends of the internodes, set at an angle of about 40° , large, campanulate, margin entire, free at the back. Sarcothecæ bithalamic, canaliculate, fixed and stout at the base; one at each side of the hydrotheca, pedunculate, one in front, one (or on the stem two) midway between every two hydrothecæ, on the same internode as the lower, and one on the proximal internode of each pinna.

Gonothecæ—female, large, pear-shaped, somewhat flattened above, tapering below, with a distinct sub-globular segment at the base of the capsule, and a sarcotheca at each side a little above the base; a circular operculum at the summit, the border of the aperture slightly thickened:—male, small, with one sarcotheca only; both sexes on the same shoot.

Hab.—Port Jackson.

The minute structure of this species is identical in every particular with that of *P. campanula*, both as regards the trophosome and the gonosome; but in *P. campanula* the pinnate branches are borne by a polysiphonic stem, while in *P. rubra* the pinnate shoots spring directly from the hydrorhiza. A stem of *P. rubra* therefore corresponds to a branch of *P. campanula*, except that it is usually larger.

PLUMULARIA SETACEA, Ellis.

P. tripartita, von Lendenfeld.

(Plate XX., figs. 14-18).

Hydrocaulus about $1\frac{1}{2}$ inches in height, monosiphonic, sometimes branched, pinnæ alternate, not close, one borne near the

summit of each internode, divided into alternate long and short internodes, of which only the former bear hydrothecæ. Hydrothecæ small, cup-shaped, much expanded upwards, adnate up to the margin, aperture nearly at right angles with the pinna. Sarcothecæ bithalamic, canaliculate, slender at the base and moveable; one below each hydrotheca and one at each side above it, one between every two hydrothecæ, on the intermediate internode, one at the base of each pinna, and one on the lower part of each stem-internode.

Gonothecæ borne in the axils, rather slender, fusiform, with a tubular neck directed to one side.

Hab.—Timaru, N.Z. (Dr. von Lendenfeld); Port Phillip Heads (Mr. J. B. Wilson).

The specimens of *P. tripartita* (which are among Dr. von Lendenfeld's types) do not possess any features by which they might be distinguished from *P. setacea*, the tripartite form of the hydranth being only an occasional feature. The hydrophyton is normally unbranched, but some of the shoots bear several lateral branches, which are very peculiar in their origin, since they commence as ordinary pinnæ or hydrocladia, and only become modified into branches beyond the first internode, which bears a hydrotheca and nematophores in the usual way. Mr. Hincks mentions a branched variety of *P. setacea* as occurring in Britain, but does not state whether the branches are modified from hydrocladia as in the present case.

Plumularia Wattsii has hydrocladia with the hydrothecæ and sarcothecæ similar in form and arrangement to those of the present species, but the pinnate shoots, instead of springing directly from the hydrorhiza, are borne on a long slender jointed stem.

PLUMULARIA TURGIDA, n.sp.

(Plate XX., figs. 12-13).

Hydrocaulus 1½-2 inches in height, monosiphonic, sometimes branched; pinnæ alternate, not close, one borne near the summit of each internode, divided into alternate long and short internodes,

of which only the former bear hydrothecæ. Hydrothecæ cup-shaped, slightly expanded upwards, adnate up to the margin, aperture at right angles with the pinna. Sarcothecæ bithalamic, canaliculate, slender at the base and moveable, one below each hydrotheca and one on each side above it, one between every two hydrothecæ, on the intermediate internode, two at the base of each pinna (one in front of the axil and one behind), and one on the lower part of each stem-internode.

Gonosome unknown.

Hab.—Lyttleton, N.Z. (von Lendenfeld).

This species is very closely allied to *P. setacea* in most respects, including the peculiar mode of branching, but is a little paler in colour, with the pinnæ more lax and less divergent. The hydrothecæ are proportionately broader at the base and less expanding upwards, while the pinna is more abruptly swollen below the hydrotheca, giving the species a somewhat distinctive aspect. Another characteristic of *P. turgida* is the presence of a sarcotheca behind each axil as well as in front. An American Hydroid identified by Clarke* with *Plumularia setacea* resembles the present species in these particulars, but is very much larger in growth, measuring sometimes as much as 300 mm.

PLUMULARIA CALICULATA, n.sp.

(Plate XX., figs. 9-10).

Hydrocaulus monosiphonic, about $\frac{1}{2}$ inch high, pinnæ alternate, not close, one borne near the summit of each internode, divided into alternate long and short internodes, of which only the former bear hydrothecæ. Hydrothecæ cup-shaped, shallow, slightly expanding upwards, adnate up to the margin, aperture nearly at right angles with the pinna. Sarcothecæ bithalamic, canaliculate,

*Hydroids of the Pacific Coast of the United States, south of Vancouver Island, &c., S. F. Clarke.—Trans. of the Connecticut Academy of Arts and Sciences, Vol. III., Part 2.

slender at the base and moveable; one below each hydrotheca, and one at each side above it, one between every two hydrothecæ, on the intermediate internode, one at the base of each pinna, and one on the lower part of each stem-internode.

Gonothecæ small, ovate or oblong, somewhat compressed, slightly narrowed at the summit.

Hab.—Bondi Bay, Port Jackson.

This species differs from *P. setacea* in its smaller size, and in the gonothecæ, which are stouter in proportion, and have no neck. As seen in side view they are nearly oblong, but in front view they are somewhat barrel-shaped. Some of them are rather abruptly narrowed towards the summit, but this is not always the case; possibly the difference is developmental. The hydrothecæ are somewhat shallower in proportion to their height than those of *P. setacea*, and more rounded. In one of the specimens the pinnæ are borne in opposite pairs at the summit of each internode, except at the upper part, where the ordinary alternate arrangement recurs.

PLUMULARIA SETACEOIDES, Bale.

Bondi.

(Plate XX., figs. 7-8).

This is a rather small form of *P. setaceoides* with short pinnæ, and, like the small southern variety, has the hydrothecæ shallower and more expanding towards the aperture than the long slender form. They are also set at a wider angle on the pinna, and have the front so much thickened as to present the appearance of an outer chitinous investment at this part. The thickened portion shrinks when the zoophyte is preserved in balsam, and even to some extent when in water. Gonangia are plentiful in these specimens, and agree in their general form with those of the type. The large sporosac is sometimes surrounded at the summit by a circle of highly refractive granules, which, as they are not present in all the gonothecæ, would appear to belong only to a particular stage of growth.

In the absence of the gonosome, the present species may be at once distinguished from *P. setacea* by the calyces being free for part of their length.

PLUMULARIA ALATA, n.sp.

(Plate XIX., figs. 6-10).

Hydrorhiza with transverse markings along the margin; hydrocaulus minute, monosiphonic, unbranched, internodes at lower part of stem fusiform, those above more slender, cylindrical; pinnae alternate, one on each internode of the stem, divided into alternate long and short internodes, of which only the former bear hydrothecae. Hydrothecae tubular, slightly curved outwards, the base springing from a protuberance of the pinna; aperture partly terminal, emarginate behind, and partly continued as a narrow sinus nearly half way down the front of the hydrotheca; the sides of the margin forming two lobes, which are somewhat recurved towards the pinna. Intrathecal ridge anterior, projecting from the front extremity of the aperture into the cell in a backward and upward direction; an external narrow projecting web partly crossing the hydrotheca and pinna on each side immediately behind the lateral sarcotheca. Hydrothecal internodes with three transverse folds or constrictions. Sarcothecae bithalamic, canaliculate, slender at the base and moveable; one immediately below each hydrotheca and two laterals behind it, one between every two hydrothecae, on the intermediate internode, two on each stem-internode, and a number scattered over the hydrorhiza.

Gonosome unknown.

Hab.— (?)

This is a noteworthy species for several reasons, not the least of which is its small size. Out of all the specimens examined the largest were only $\frac{1}{8}$ inch in height, or less than any other known Plumularian. The form of the hydrotheca, more especially of the aperture, is unlike that of any other species, the aspect presented in a front view being that of a narrow longitudinal opening half

the length of the hydrotheca, terminating below in a slight rounded enlargement, and above in a similar but larger extension at the end of the hydrotheca. The supracalycine sarcothecæ are set behind the upper part of the hydrotheca, so that in a front view they can only be seen by focussing down through it. The possession by this species of a distinct intrathecal ridge, anterior in position, is a feature which, though common among the Australian Statoplea, has not hitherto been recorded as occurring in any member of the Eleutheroplean group, except in a single doubtful species, *Azygoplon productum*; the true Plumulariæ which are furnished with an intrathecal ridge, as *P. spinulosa*, *P. filicaulis*, &c., having it in a posterior position. The lateral external webs, which appear to partly shelter the lateral sarcothecæ, are so delicate that they escape observation except on a careful scrutiny. Somewhat similar structures occur in *P. filicaulis*.

P. alata was found growing on a red frondose alga, which was given to me by Dr. Ralph, who was uncertain whether it had been collected in New Zealand or Victoria.

PLUMULARIA SPINULOSA, Bale.

(Plate XIX., figs. 11-13).

Coogee Bay (Mr. Whitelegge).

The gonosome of this species has been hitherto unknown, but Mr. Whitelegge's specimens contain some gonothecæ, which are very large, ovate, truncate above, and with the margin rather widely everted. They somewhat resemble those of *P. obliqua*, a species which agrees with the present in many respects, especially in the form and arrangement of the sarcothecæ. *P. spinulosa* however may be distinguished by the more compressed hydrothecæ, the large intrathecal ridge, the abrupt narrowing of the pinna behind the calycle, and by the pinna being pointed at the end. The specimens from Coogee differ from those I had previously seen in having the pinna shorter, terminating in a blunt conical

point, which only rises about as high as the rim of the hydrotheca, instead of being produced into a longer spine. The hydrothecæ also are proportionately longer from back to front.

Bondi Bay. PLUMULARIA PULCHELLA, Bale.

A few fragments of this species occurred along with specimens of *Pasythea quadridentata*, from the above locality.

PLUMULARIA COMPRESSA, Bale.

Botany. (Plate XIX., fig. 14).

Except that the base of the hydrotheca is sometimes a little less angular, these specimens agree with the type in all but size, being only about $\frac{1}{6}$ of an inch high, with all the parts small in proportion. The gonosome was wanting.

PLUMULARIA AURITA, n.sp.

(Plate XIX., figs. 15-19).

Hydrocaulus monosiphonic, unbranched, about $\frac{1}{4}$ inch in height; stem slender, pinnæ alternate, each borne near the summit of an internode, and supporting a single hydrotheca; distal part curved from under the base of the hydrotheca, smooth, swollen at the summit on the inner side. Hydrothecæ rounded at the base, slightly compressed laterally, aperture at right angles to the cell and pinna, margin sinuated behind down to the summit of the pinna, no intrathecal ridge. Sarcothecæ monothalamous, or with a rudimentary division, canaliculate, stout at the bases, one below each hydrotheca, fixed, its oblique aperture almost appressed to the front of the cell, one at each side above the hydrotheca, very large, open on one side nearly down to the base, one in each axil, simple, bract-like.

Gonothecæ from 3 to 4 times the length of the hydrotheca, very convex behind, nearly straight in front, aperture looking outwards

and partly downwards, margin not everted, an incomplete partition extending some distance into the neck, from just below the orifice.

Hab.—Botany.

This species is very closely allied to *P. compressa*, but may be distinguished by the more slender hydrosoma, the rounder basal part of the hydrotheca, the large supracalycine sarcothecæ, the absence of the intrathecal ridge, and by the margin of the hydrotheca being less elevated above the top of the pinna, as well as by the distinct gonothecæ.

STATOPLEA.

I have elsewhere* given reasons for modifying Professor Allman's definitions of the genera *Aglaophenia* and *Lytocarpus*, and need only mention here that the former genus is taken to comprise all those species which combine the typical trophosome of the *Statoplea* with a gonosome distinguished by the presence of a *corbula*, open or closed, and variously modified, but always composed of a number of ribs or leaflets (*nematocladia*) which spring from a modified pinna; while *Lytocarpus* consists of species which have a similar trophosome, but in which the gonangia are borne on separate *nematocladia*, each of which is formed by the modification of a distinct pinna.

It is generally considered, in accordance with the views of Professor Allman, that the rachis of the *Aglaophenian* corbula is a modified hydrocladium, and the ribs the modified mesial nematophores of the hydrothecæ which are sometimes present, but in other cases are suppressed. It was formerly supposed that the corbula was formed from a branch, and that the ribs were modified pinnæ, but to this view it was objected that the corbula took the place of a pinna, and that the frequent presence of one or more hydrothecæ on the basal part of the rachis negated the idea of its being a branch. From the descriptions of *P. setacea* and *P.*

*"The Genera of the Plumulariidae," &c. Trans. Royal Soc. of Victoria, Vol. XXIII. (1887), page 83.

turgida in the present paper, however, it will be seen that ramules which commence as true hydrocladia like the rest may become transformed beyond the first internode into true branches, with exactly the same structure as the stem. It is therefore an open question whether the same thing does not happen in *Aglaophenia*, the rachis of the corbula forming a true branch, and the ribs being modified hydrocladia. It may be noted that two of the species of *Aglaophenia* described in this paper have the gonangial ramulus provided with a series of sarcothecæ only below the corbula, like the proximal portions of the ordinary branches in some species.

LYTOCARPUS PHILLIPINUS, Kirch.

(= *Aglaophenia urens*, Bale (not Kirchenpauer).

(Plate XXI., figs. 5-7).

Hydrocaulus polysiphonic, branched, 7-8 inches in height, the primary branches all directed to one side, curved outward; branchlets forming rather a small angle with the main branches; pinnæ close, alternate, one on each internode, both series springing from the front of the stem or branch. Hydrothecæ parallel with the pinna in their longer diameter; basal part constricted on the side next the pinna; deeply constricted between the aperture and the mesial sarcotheca, and abruptly recurved, so that the aperture is nearly vertical; aperture wide, the sides elevated, each forming an angular lobe (sometimes rounded); front entire or with a small tooth, back straight or slightly sinuated, free. Hydrothecal internodes with two slight divergent folds or constrictions—one nearly opposite the basal constriction of the hydrotheca, the other at the base of the lateral sarcothecæ. Mesial sarcotheca nearly double the height of the hydrotheca, adnate to it nearly as far as the constriction on the upper side, and mainly rising from it; free part projecting forward, tapering, with distinct terminal and lateral apertures, and an orifice opening into the hydrotheca. Lateral sarcothecæ tubular, divergent, adnate to the hydrotheca as far as the margin and rising above it, inclined at about the same angle as

the mesial sarcotheca, but with the free part usually directed more forward; terminal and lateral apertures distinct. Cauline sarcothecæ conical, with terminal and lateral apertures sometimes united—two on the stem at the base of each pinna, and one on the pinna itself.

Gonangial pinnæ supporting a hydrotheca on the first internode, and on each of the next two (or sometimes on one only) a gonotheca, which springs from a prominence consisting of a modified hydrotheca with mesial and lateral sarcothecæ; the rest of the pinna forming a nematocladium of several internodes, bearing sarcothecæ mostly arranged in sets of three (one mesial and two lateral). Gonothecæ ovate or rounded, much flattened, and provided with a marginal wing, the sporosac surrounded by a circle of highly refractive granules.

Colour, light brown.

Hab.—Moreton Bay, Queensland, very common, obtained in the dredge (Mr. John Brazier): Manila (Kirchenpauer).

The specimens which I received from Mr. Brazier included the gonosome, which, as well as the trophosome, agrees very well with Kirchenpauer's figures and description. The ramification of this species is peculiar, the straight or slightly curved stem giving origin to a number of branches which are almost always directed to one side: examined closely, however, they are usually found to form two series, being directed alternately a little to the right and left. Normally, each side of the hydrotheca forms an angular lobe, but these lobes are often rounded off so that the sides are only slightly elevated.

Among the first hydroids sent to me from the Australian Museum were two specimens which I referred in the "Catalogue," but with much doubt, to the *Aglaophenia urens* of Kirchenpauer. According to Kirchenpauer the hydrotheca-margin of *A. urens* is entire, while in the specimens referred to it forms angular or rounded lobes at the sides, a difference, however, which did not appear of great importance. But the branches of *A. urens* are

represented as widely divergent, which was not the case with the Museum specimens, and I have observed that the angle at which branches spring from the stem usually varies but little within the limits of a species. These specimens now appear to me identical with *A. phillipina*, the hydrothecæ and sarcothecæ being exactly similar to those of Mr. Brazier's specimens, and the hydrothecæ varying in the same directions, the branching, as nearly as I could judge from the specimens, (which were fragmentary) being also similar. The only difference which I can find is in the colour, which is somewhat darker, but this is partly due, both in the original specimens, and in another of the same type in the present collection, to a number of minute black specks scattered irregularly over the interior of the polypary, and which are probably not constant. On the whole, though the gonosome is absent, I have little doubt that the specimens which I formerly described as *A. urens* belong really to *A. Phillipina*.

In Kirchenpauer's description no mention is made of the fact that the gonothecæ spring from modified hydrothecæ, but his figure shows this as the structure. He describes the sarcothecæ above the gonothecæ as being in pairs decussately arranged, but though they may present such an appearance in certain aspects, most of them are really in threes, representing the mesials and laterals of the suppressed hydrothecæ. The first one or two above the gonotheca, however, are borne at the side of the nematocladia without any to correspond on the opposite side. The gonothecæ are supported on very long internodes, and the contents of the proximal one ripen first; in fact, I found in most cases only one on the nematocladium, the first having ripened and fallen off. Sometimes, however, only one is produced. The young gonothecæ are nearly circular in outline, with a broad marginal wing, but those which are fully developed are ovate, with the gonotheca larger and the wing narrower. The ring of granules surrounding the sporosac is similar to those of *Halicornaria* (*Lytocarpus*) *saccaria*, which has been described by Professor Allman (Journal of the Linnean Society, Zoology, Vol. XII.).

The thread-cells (which I found in all the specimens) are slender-lanceolate bodies, often slightly curved and reaching an unusual size (about 3-1000 of an inch). The sheath, or axial body, is a very hyaline structure, with markings resembling a loosely-coiled double spiral; the dart is an exceedingly fine simple filament 1-100 of an inch, or even more, in length. They are found in profusion, not only in the sarcothecæ, but within the cavity of the hydrocaulus, where it seems impossible that they should be of any value as weapons of offence or defence.

Besides the two sarcothecæ on the stem at the base of each pinna, there is one on the basal part of the pinna itself, a feature which I have not observed in any other species.

The ultimate branches (which are often monosiphonic throughout or in part) have a long oblique joint near the base, between which joint and the origin of the branch there is a series of median sarcothecæ, but no pinnæ.

LYTOCARPUS URENS, Kirch., sp.

(*Aglaophenia urens*, K.)

While the specimens which I described and figured in the "Catalogue" under the name of *Aglaophenia urens*, K., appear to belong to *Aglaophenia* (*Lytocarpus*) *Phillipina*, K., it is probable that the description there given will apply in most particulars to the true *A. urens*. Kirchenpauer, however, represents the hydrotheca of that species with the margin entire, or, in Australian specimens, with a small anterior tooth, but without angular lobes at the sides. I am not aware whether *L. urens* has a sarcotheca on the basal part of each pinna, like *L. Phillipinus*.

According to Kirchenpauer's figure and description there is a polysiphonic stem 7-8 inches high, with branches which are mostly divergent almost at right angles, and some of which are rebranched. The stem is blackish, the branches lighter, and the pinnæ are very short. The hydrothecæ and sarcothecæ are of the same general type as those of *L. Phillipinus*, except in the absence of the angular

lobes at the sides of the former. Each gonangial pinna bears a single gonotheca with a pair of sarcothecæ, and the distal portion is reduced to a blunt spine. The proximal internode bears appendages, but the figure is not sufficiently detailed to indicate whether they are hydrothecæ or sarcothecæ. The gonothecæ are described as unusually small, but visible to the naked eye as black points. The ring of bright granules, which in the allied species surrounds the sporosac, is not shown in Kirchenpauer's figure of this species.

L. urens possesses powerful urticating properties, being described as stinging like a nettle.

AGLAOPHENIA PARVULA, Bale.

Hab.—Port Jackson.

In these specimens the second tooth on each side of the hydrotheca is almost completely merged with the third, a condition also common in Victorian specimens.

AGLAOPHENIA SINUOSA, n.sp.

(Plate XXI., figs. 1-2).

Hydrocaulus monosiphonic, slightly branched, 1-2 inches high; pinne long, approximate, alternate, one on each internode. Hydrothecæ set at an angle of about 40° , tapering to the base, with two well-developed intrathecal ridges, one close to the base of the calycle, on the side next the pinna, the other near the middle on the opposite side; the hydrotheca constricted at each of the ridges; aperture nearly horizontal, margin with a median tooth in front and four teeth on each side, the last pair opposite the lateral sarcothecæ, (one pair sometimes obsolete), back adnate; a median ridge or keel running along the front of the hydrotheca from the anterior intrathecal ridge and terminating in a point over the median marginal tooth. Hydrothecal internodes *sometimes* provided with 1-3 transverse folds. Mesial sarcotheca about half the length of the hydrotheca, or rather less, prominent, canaliculate. Lateral

sarcothecæ canaliculate, abruptly curved outwards, projecting forwards about as far as the margin of the hydrotheca. Cauline sarcothecæ broad, canaliculate, two on the front of the stem at the base of each pinna, and a large one, usually bifid, behind each axil.

Gonangial pinna bearing a single hydrotheca below the corbula. Corbula consisting of about 10 pairs of alternate ribs, each springing from a separate internode of the rachis, expanded into rather narrow leaflets, which are united to each other so as to form a closed corbula; the lines of union of the leaflets indicated by narrow thickened ridges (without sarcothecæ), a median ridge running up each leaflet bearing a series of canaliculate sarcothecæ; the median ridge often united to the next junction-ridge behind by a few irregular short thickenings; a bifid sarcotheca on the basal part of each leaflet, situated between the median ridge and the distal margin; one (or two?) sarcothecæ on the rachis at the base of each leaflet.

Colour, brown.

Hab.—Port Denison.

The largest specimen I received was about $1\frac{1}{2}$ inches long, with a single branch near the foot. The species may be readily distinguished by the structure of the hydrothecæ, which are peculiar in having both the anterior and posterior intrathecal ridges fully developed, and forming two partitions, each projecting half-way through the hydrotheca, but in opposite directions. The keel which extends along the front of the hydrotheca is also an unusual feature. The corbula is completely closed, and the leaflets which compose it are narrower than is usual in closed corbulæ, so that the rows of sarcothecæ are closer together, while their position is along the middle of each leaflet, not as is generally the case at the margin.

AGLAOPHIENIA MACROCARPA, n.sp.

(Plate XXI, figs. 3-4).

Hydrocaulus polysiphonic, with divergent branches, stem and main branches thick and woody, pinnae approximate, alternate,

one on each internode, both series borne towards the front. Hydrothecæ rather long, set at an angle of about 40° , nearly cylindrical in the distal half, and tapering downwards to the base; a fold or rudimentary intrathecal ridge near the base on the side next the pinna; aperture with a sharp pointed median tooth in front, and on each side a short tooth and a broad rounded lobe, the latter uniting with the lateral sarcothecæ, back slightly sinuated, adnate. Hydrothecal internode with two transverse folds, one opposite the base of the lateral sarcothecæ, the other opposite the rudimentary intrathecal ridge. Mesial sarcotheca about $\frac{2}{3}$ as long as the hydrotheca, adnate, only slightly projecting, canaliculate. Lateral sarcothecæ canaliculate, directed forward and strongly outward, projecting a little beyond the hydrotheca-margin. Cauline sarcothecæ conical, canaliculate, two on the stem at the base of each pinna.

Gonangial pinna with two or three short distinct joints at the base, bearing only sarcothecæ. Corbula very long, consisting of nearly 20 pairs of alternate ribs, springing from separate internodes of the rachis as narrow pinnules, but expanding above into broad leaflets, which are attached to each other along the margins, the lines of union being provided with a series of small canaliculate sarcothecæ: a short lateral spur projecting outwards and forwards from the distal side of each rib just above the base, bearing several sarcothecæ larger than the rest, but no hydrothecæ. One or more of the proximal ribs free, not expanded. A small sarcotheca on the rachis below the origin of each rib.

Colour, dark brown.

Hab.—Off Port Jackson.

The specimens were incomplete, the principal one consisting of a fragment of the fascicled stem with two branches about an inch apart on the same side set almost at right angles with the stem, the longer one being complete, and about three inches long. The piece of stem was about $\frac{1}{10}$ inch in diameter, and retained the pinnæ almost throughout. The form of the hydrotheca-margin is different from that of any other species known to me, and the

species may be readily distinguished by it. The corbula (which sometimes exceeds one-fourth of an inch in length) is closed above, but the sudden narrowing of its component leaflets towards the base leaves openings, across which project the lateral spines, corresponding to the processes which in some species bear hydrothecæ, but which here support only 2-4 sarcothecæ.

AGLAOPHIENIA PHYLLOCARPA, n.sp.

(Plate XXI., figs. 9-10).

Hydrocaulus polysiphonic, pinnae alternate, one on each internode, both series springing from the front. Hydrothecæ lying parallel with the pinna, very large, elongate, sub-cylindrical; a slight fold or rudimentary intrathecal ridge near the base on the side next the pinna; aperture oblique, with eleven nearly equal claw-like incurved teeth, one median, and five on each side, back deeply sinuated next to each of the lateral sarcothecæ, and with a broad rounded lobe between, adnate to the pinna. Hydrothecal internode narrow, with 3 transverse folds, one opposite the fold in the hydrotheca, one at the base of the lateral sarcothecæ, and one midway between. Mesial sarcotheca very short, projecting outwards from the pinna and the basal part of the hydrotheca, free part conical, canaliculate. Lateral sarcothecæ canaliculate, projecting outwards and extending beyond the hydrotheca-margin, free part conical, directed forwards, slightly upwards, or downwards, sometimes abruptly recurved so as to point towards the back of the pinna, and away from the hydrotheca at a right angle. Cauline sarcothecæ on the front of the stem, two at the base of each pinna, the lower larger.

Gonangial pinna with 3 or 4 short distinct joints at the base, bearing only sarcothecæ. Corbula large, consisting of about 10 pairs of alternate ribs, expanded into very large leaflets, each of which is attached by its proximal margin to about the middle of the next leaflet behind; the distal half of each leaflet forming a large free expansion bordered with canaliculate sarcothecæ; each

main leaflet giving origin at the base to a smaller secondary free leaflet, which is directed forwards and downwards, and has the anterior margin fringed with sarcothecæ.

Colour, brown.

Hab.—Port Denison.

This species, in the form and position of the calyces and the relative shortness of the mesial sarcothecæ, is wholly unlike any other Australian species yet known. I have received only a single incomplete specimen about $\frac{3}{4}$ of an inch long. The pinnae are long and the stem is slender, composed of two or three tubes only. The corbula is very remarkable, as half of each leaflet is devoted to the formation of the proper corbula-wall, while the other half is a broad free wing. The secondary leaflets take the place of the process which in some species bears a hydrotheca, but are peculiar from their comparatively large size. The two series of these appendages are directed backwards from the corbula, so that the rachis is between them. Only one corbula was present.

AGLAOPHEDIA (?) WHITELEGGEI, n.sp.

(Plate XXI., fig. 8).

Hydrocaulus polysiphonic, with ascending branches; pinnae long, alternate, one on each internode, both series springing from the front. Hydrothecæ having their proximal portion nearly parallel with the pinnae, distal portion curved outwards so that the aperture is nearly vertical, a fold or rudimentary intrathecal ridge a little above the base, on the side next the pinna, aperture with a long slightly incurved tooth in front, and two triangular or slightly rounded lobes at each side, back entire, free. Hydrothecal internodes with two folds, one opposite the fold of the hydrotheca, the other at the base of the lateral sarcothecæ. Mesial sarcotheca tubular, a little longer than the hydrotheca, free part projecting, somewhat swollen in the middle, with distinct terminal and lateral apertures, and an orifice opening into the hydrotheca. Lateral sarcothecæ tubular, divergent, adnate to the hydrotheca as far as

the margin, and projecting beyond it, less inclined forward than the mesial, except the distal portions, which are bent forward; terminal and lateral apertures distinct. Cauline sarcothecæ usually canaliculate, two on the stem at the base of each pinna.

Gonosome unknown.

Colour, stems and branches light brown, pinnæ whitish.

Hab.—?

In the absence of the gonosome the generic position of this species is doubtful, a similar type of hydrotheca being found in species of *Aglaophenia*, *Lytocarpus*, and *Halicornaria*. It differs from most allied species in having each side of the hydrotheca-margin cut into two nearly equal angular lobes instead of one large one. The distal part of the hydrotheca is bent away from the pinna, but not sharply recurved, as in *L. Phillipinus* or *A. longicornis*, so that there is no sharp deep constriction of the front of the hydrotheca as in those species, nor anterior intrathecal ridge, as in *A. plumosa*.

The only specimen I received is about two inches high, but is incomplete; there are three or four branches, and the pinnæ extend along the greater part of the stem. The pinnæ and hydrothecæ are colourless, and when filled with remains of the soft parts appear white; they are very fragile and apt to shrivel when dried or placed in balsam. Possibly, however, other specimens may be more robust.

EXPLANATION OF PLATES XII.-XXI.

The figures have been drawn with the assistance of the camera lucida, from specimens viewed as transparent objects.

PLATE XII.

Fig. 1-2. — *Obelia australis*, v. Lend. Lyttleton, N.Z. (from Dr. von Lendenfeld's type specimen).

Fig. 3. — *Obelia angulosa*, n.sp. Parramatta River.

Fig. 4.—*Campanularia* (?) *serrulata*, n.sp. Port Jackson.

Fig. 5.— „ „ (?) *bispinosa*, n.sp. Port Jackson.

Fig. 6.— „ „ „ a portion of the calycle-margin, seen from outside.

Fig. 7.—*Campanularia bispinosa*, one of the marginal teeth, lateral view.
(All except 6 and 7 magnified 40 diameters).

PLATE XIII.

Fig. 1-3.—*Campanularia caliculata*, Hincks. Port Jackson. (All from one colony).

Fig. 4-7.—*Campanularia caliculata* var. *makrogonia*, v. Lend. Port Jackson.
Different hydrothecæ from the same colony.

Fig. 8.—*Campanularia caliculata* var. *makrogonia*, outline of gonotheca.

Fig. 9-10.—*Eucopella campanularia*, v. Lend. Bondi.

Fig. 11.— „ „ „ irregular calycle, from the same colony.

Fig. 12-14.—*Eucopella campanularia*, from another variety.

Fig. 15.— „ „ „ gonotheca, same specimen.

Fig. 16.—*Lafŕea scandens*, n.sp., on *Sertularella divaricata*. Port Jackson.

Fig. 17.— „ „ „ base of hydrotheca, from behind.

Fig. 18.— „ „ „ gonotheca, with contents.

Fig. 19.— „ „ „ „ less advanced.

(All except 17 magnified 40 diameters).

PLATE XIV.

Fig. 1.—*Halecium gracile*, n.sp., with male gonotheca. Port Jackson. $\times 40$.

Fig. 2.— „ „ „ Port Stephens. $\times 40$.

Fig. 3.— „ „ „ female gonotheca. $\times 40$.

Fig. 4.— „ „ *parvulum*, n.sp. Bondi. $\times 40$.

Fig. 5.— „ „ „ with female gonotheca. $\times 40$.

Fig. 6.—*Pasythea quadridentata*, Ellis and Sol. Bondi. $\times 25$.

Fig. 7.— „ „ „ Coogee. $\times 25$.

Fig. 8-9.— „ „ *hexodon*, Busk. Moreton Bay. $\times 25$.

PLATE XV.

- Fig. 1.—*Sertularella indivisa*, Bale. Port Phillip.
 Fig. 2.— „ „ „ „ Portland, Vict.
 Fig. 3.— „ „ *solidula*, Bale. Port Phillip.
 Fig. 4.— „ „ „ „ Bondi.
 Fig. 5-7.— „ „ *variabilis*, n.sp. Port Jackson.
 Fig. 8.— „ „ „ „ a variety with longer teeth.
 Fig. 9.— „ „ „ „ a slender variety, with calyces nearly smooth, and directed to the front so as to show inside the aperture.
 (All magnified 40 diameters.)

PLATE XVI.

- Fig. 1-2.—*Sertularella divaricata*, Busk, var. *dubia*, n. var. Bondi.
 Fig. 3-4.— „ „ *divaricata*, var. *sub-dichotoma*, n. var. Port Jackson.
 Fig. 5-6.— „ „ *longithecæ*, n.sp. Port Denison.
 Fig. 7.— „ „ *cylindrica*, n.sp. Port Jackson.
 Fig. 8.— „ „ *microgona*, v. Lend. Port Phillip. (From one of Dr. von Lendenfeld's types)
 (All magnified 40 diameters.)

PLATE XVII.

- Fig. 1-2.—*Syntheccium orthogonia*, Busk. Port Jackson,
 Fig. 3.— „ „ „ „ a specimen with calyces directed towards the front.
 Fig. 4.—*Syntheccium orthogonia*, gonotheca, narrower aspect.
 Fig. 5.— „ „ „ „ broader aspect.
 Fig. 6-9.—*Sertularia geniculata*, n.sp. Port Jackson.
 Fig. 10-11.— „ „ „ „ gonothecæ.
 (All magnified 40 diameters.)

PLATE XVIII.

- Fig. 1-2.—*Sertularia complexa*, Clarke. Bondi. × 40.
 Fig. 3-4.— „ „ „ „ gonothecæ. × 40.
 Fig. 5.—*Thuiaria subarticulata*, Coughtrey. New Zealand. × 25.

Fig. 6-7.—*Thuiaria subarticulata*, hydrothecæ, more enlarged.

Fig. 8.— „ „ (= *Sertularia fertilis*, v. Lend.) with all the calyces except one broken away. × 25. (From Dr. von Lendenfeld's type).

Fig. 9-10.—*T. sinuosa*, n.sp. Port Mollo. × 25.

PLATE XIX.

Fig. 1-4.—*Azygoplou productum*, Bale. Various forms of hydrothecæ. × 80.

Fig. 5.— „ „ adnate gonotheca. × 25.

Fig. 6.—*Plumularia alata*, n.sp. × 80.

Fig. 7-10.— „ „ × 112.

Fig. 11.— „ *spinulosa*, Bale, variety from Coogee. × 80.

Fig. 12-13.— „ „ gonothecæ. × 20.

Fig. 14.— „ *compressa*, Bale, small variety, Botany. × 80.

Fig. 15-17.— „ *aurita*, n.sp. Botany. × 80.

Fig. 18-19.— „ „ gonothecæ. × 20.

PLATE XX.

Fig. 1-2.— { *Plumularia campanula*, Busk.
 „ „ *rubra*, v. Lend.

These figures apply equally to both species.

(From Dr. von Lendenfeld's type of *P. rubra*). × 80.

Fig. 3.—*Plumularia campanula*, female gonotheca. (From Dr. von Lendenfeld's type *P. Torresia*. *P. campanula*, from Port Phillip Heads, has exactly similar gonotheca). × 25.

Fig. 4.—*Plumularia campanula* and *P. rubra*, male gonotheca. (From Dr. von Lendenfeld's type *P. rubra*). × 25.

Fig. 5.—*Plumularia campanula* and *P. rubra*, female gonotheca. (From a N.S. Wales specimen of *P. campanula*). × 25.

Fig. 6.—*Plumularia campanula* and *P. rubra*, male gonotheca. (From same as last). × 25.

Fig. 7.—*Plumularia setaceoides*, Bale. Lax variety, with thickened cell-wall. × 80.

Fig. 8.—*Plumularia setaceoides*. Small variety, much thickened. × 80.

- Fig. 9.—*Plumularia caliculata*, n.sp. Port Jackson. × 80.
 Fig. 10-11.— „ „ Gonothecæ, front and side views. × 25.
 Fig. 12-13.— „ *turgida*, n.sp. Lyttleton, N.Z. × 80.
 Fig. 14.— „ *setacea*, Ellis. Port Phillip. × 80.
 Fig. 15.— „ „ (From v. Lendenfeld's type *P. tripartita*). × 80.
 Fig. 16.— „ „ Gonotheca. (Same as last). × 25.
 Fig. 17-18.— „ „ Gonothecæ. Port Phillip. × 25.

PLATE XXI.

- Fig. 1-2.—*Aglaophenia sinuosa*, n.sp. Port Denison. × 80.
 Fig. 3-4.— „ „ *macrocarpa*, n.sp. Off Port Jackson. × 80.
 Fig. 5.—*Lytocarpus Phillipinus*, Kirch. Moreton Bay. × 80.
 Fig. 6-7.— „ „ Gonothecæ in different stages. × 20.
 Fig. 8.—*Aglaophenia* (?), *Whiteleggei*, n.sp. × 80.
 Fig. 9-10.— „ „ *phyllocarpa*, n.sp. Port Denison. × 80.

CARBONIFEROUS AND SILURIAN FOSSILS FROM
CENTRAL NEW SOUTH WALES.

BY REV. J. MILNE CURRAN, F.G.S.

The central district of New South Wales lying between the Lower Bogan and Upper Darling, has not, up to the present, yielded any organic remains. Palæontologically speaking, it is decidedly the most barren area in the colony. No mention is made of fossils from any of its rocks in De Koninck's *Recherches*, or in the lists published by Stutchbury, Strzelecki, and Clarke, or in the valuable Reports of the Department of Mines. The latest geological maps represent part of this country as "not geologically examined," while the remainder is coloured as being occupied by granite, Silurian or Devonian rocks. The Silurian and Devonian formations are represented without doubt, but their identification has depended entirely on general lithological or petrological resemblances. In collecting materials to work out some points in the geology of this little known part of the colony, I have discovered some interesting fossils, which have been so far identified as to give a definite position to the beds containing them. As it may be a long time before I get an opportunity to make use of all the facts that have come under my notice, I may be allowed to place on record the discovery of the fossils named below. It will lend some importance to these notes to remember that over the greater portion of this part of New South Wales "accurate geology is simply impossible." There is no good topographical map in existence. The country is in great part clothed with "Mallee" scrub, and pine forests. Fossils are rare, and over long distances the bed rock is hidden by superficial deposits. There are no running streams, and no ravines to expose natural sections. I am fairly well acquainted with the country between Bourke on the north, and the "divide" of the

Bogan and Lachlan waters at Nangeribone to the south, a distance of 160 miles in a direct line. There is not, to my knowledge, in this stretch of country one natural cutting exposing any section of strata worth noting. We have here many thousand square miles of land, naturally waterless, with no mountains properly so-called, elevated on an average nine hundred feet above sea level, and yet suffering no denudation. Detrital matter from the hills is simply spread out at their bases. Judging from analogy and allowing for a smaller rainfall, the general surface should suffer to an appreciable extent. As a matter of fact the district loses nothing, for our creeks even in flood time rarely reach the Darling or the Lachlan, much less the sea. No matter representing disintegrated rock is carried to any distance, and any denudation there is, is purely local.

The fossiliferous beds herewith enumerated are all that, at the present time, are known to exist in an area measuring one hundred by one hundred and fifty miles.

LOWER CARBONIFEROUS.—BABINDA SANDSTONES.

As a rule basalt and igneous rocks are rare in this district, but at New Babinda Station on the road from Nymagee to Nyngan, patches of basalt, quartz-porphry, and diorites are met with. Intimately connected with these rocks is a series of coarse and fine-grained ferruginous sandstones. They are limited in extent, not occupying more than 50 square miles at the outside. These sandstones owe their preservation in a great measure to a selvage of the intrusive rocks referred to. For some years I have collected fossils from the rocks in this locality. I endeavoured, without success, to engage the attention of various palæontologists in Europe, and it was not until I sent a small collection to Mr. R. Etheridge, jun., of the British Museum (now of Sydney), that I was able to get reliable information about these shells. The Babinda fossils are not well preserved; the matrix is coarse and friable. Unhappily the imperfect condition of the specimens sent to Mr. Etheridge, rendered it impossible for him to do more than

identify the following:—*Spirifer duodecimcostata*, McCoy; a *Pterinea*-form, the shell easily distinguished by its sharp radiating tuberculated ridges, and new to N. S. Wales; a *Gervillea*-like bivalve, probably allied to some shells figured by Dana in the "Geology of the U. S. Exploring Expedition." The greatest interest naturally attaches itself to the *Spirifer*. In this colony *S. duodecimcostata* seems a purely Carboniferous species. De Koninck gives, on the authority of Clarke and McCoy, the following localities for the same shell, Wollongong, Bombaderra Creek, Stroud, and Adelong. It is also mentioned in Clarke's "Southern Gold Fields" as a Carboniferous fossil. From an examination of the rocks at New Babinda, I should incline to class the beds as Devonian. But if, on the slender evidence we have, we assign them to any horizon "the balance of evidence points rather to the Carboniferous than Devonian" (Etheridge, MS. Nov. 1, 1886).

The following directions will guide future investigators to the locality. On the Parish Map of Babinda, County of Flinders, find the point where the northern boundary of the parish cuts the Nymagee and Nyngan surveyed road. Mark off one statute mile due west from this point. The sandstone hills hereabout are fossiliferous. Two miles north-west from this point fossils may be readily detected in the sandstone ridges.

DEVONIAN { PULPULLA SANDSTONES.
 { NYMAGEE AND SANDY CREEK SANDTONES.

To the north-west of Cobar there is an extensive development of sandstones, with massive conglomerates at their base, and minor beds of conglomerates at higher levels. The only fossils known are, casts of crinoidal stems, tracks of a Crustacean (?) on slabs with ripple-marks. Crinoidal casts are also found in an altered sandstone, or quartzite, eight miles to the west of Cobar. The sandstones at Pulpulla have furnished some beautiful examples of ripple-mark on large slabs, on some of which are found the tracks of a small animal probably a crustacean. It isobvious that these

parallel and wavy ridges, left by the last ripple of water, will play an important part when the origin of the sandstones comes to be dealt with. If a single impression on either side of the median line be substituted for the double mark in Fig. 113b. of Prestwich's Geology, Vol. II., a fairly correct idea may be formed of the track-marks at Pulpulla.

UPPER SILURIAN	{	ROOKERY LIMESTONES.
		WEST GRENFELL SANDSTONES.
		BALOWRA LIMESTONE.
		HERMITAGE LIMESTONE.

On the Rookery Station, twenty-two miles south-east of Cobar, limestone is abundant. The beds are highly inclined with a westerly dip. Wherever the limestone is not altered to a saccharoid texture, it is found to be more or less fossiliferous. Mr. Etheridge determined the following species from this locality:—*Chonetes* sp.; *Strophomena corrugatella*, Davidson; *Spirifer plicatella*, Linn. In addition to these I have found fragments of a gasteropod resembling *Loxonema*, *Orthoceras*, and some indeterminate corals. The Rookery beds will yield an abundant harvest to a systematic search for fossils. *Spirifer plicatella*, it need hardly be stated, is one of the characteristic fossils of the Wenlock, which have become familiar through the cuts in Geological Text-books (see Prestwich, Vol. II., Plate III., fig. 10). It has not been found before in N. S. Wales, but is recorded from the Upper Silurian of Kilmore Creek, Victoria. We may with some show of reason refer the Rookery limestones to the Upper Silurian.

The fossils may be found in the limestone of the Homestead paddock, a few hundred yards to the north-west of Mr. Hurley's house; and in limestone on the station generally.

On Mount Grenfell Station, about twenty-four miles north-west of Cobar, fossils are found in water-worn boulders over many parts of the run. *In situ*, they are abundant at the new dam thrown

across the creek at Bevan's. The matrix is a fine-grained sandstone stained with iron. The moulds left by the removal of the original shells are again filled in, and the casts can be easily separated from the enclosing rock. I am once more indebted to Mr. Etheridge for examining some specimens sent to the Department of Mines. The following were recognised:—*Rhynchonella Wilsoni*, var. *Davidsoni*, McCoy; *Orthis* sp.

The first-named shell is another characteristic form from the Wenlock limestone of England. I can find no record of its occurring elsewhere in New South Wales. Prof. McCoy (Prog. Rept. No. IV., p. 155) makes mention of it in a tabular list of Victorian fossils, with the remark, "limited to the Upper Silurian."

At Balowra, fourteen miles south-east of Nymagee, about a square mile of limestone is exposed, on the road to Naugeribone. In some places the stone seems entirely composed of indeterminate casts of Crinoidal stems; a limestone with Crinoidal casts is also found twenty-five miles to the east of the Rookery beds already referred to.

The little that is yet known of the rocks and fossils enumerated, the nature of the country, the scarcity of any sections of strata, and the difficulty of even getting together the slender materials for the above observations, may give these notes some little value.

NOTE.—Since this paper was written, the Annual Report of the Department of Mines, New South Wales, for the year 1887, has been published. On p. 166, Mr. Etheridge, Palaeontologist to the Geological Survey, records the following additional species from the Rookery Limestones, from specimens collected by Mr. W. Anderson and myself:—*Beyrichia* sp.; *Fenestella* sp.; *Helicolites* sp.; *Chonetes striatella*, Dalman; *Spirifera crassa*, Linn.; *Atrypa reticularis*, Linn.; *Pentamerus* sp.; and *Rhynchonella Wilsoni*, Sby.

NOTES ON AUSTRALIAN *COLEOPTERA* WITH
DESCRIPTIONS OF NEW SPECIES.

BY THE REV. T. BLACKBURN, B.A., CORR. MEM. LINN. SOC. N.S.W.

The following memoir, like others that I have written under a similar title, is of a somewhat miscellaneous character. The very limited amount of leisure time at my disposal and the shortness of the intervals in which it occurs, render it very difficult for me to make an exhaustive study of an individual family, or even genus; and I have usually to be content with merely noting from time to time the characters of new genera or species that may come haphazard into my hand, observations on synonymy, and aught else that may appear to call for publication. This I trust will be accepted as an apology for the too miscellaneous contents of the memoir.

I have the greater pleasure in offering the memoir to the Linnean Society, because it gives me the opportunity of expressing in the pages of their Proceedings my acknowledgments of the assistance I have received in its preparation through the courtesy of the Hon. William Macleay, who has been good enough to compare with his types some South Australian forms, and so enable me to feel confident that I am working in harmony with the many valuable publications on Australian *Coleoptera* that he has put forth.

C A R A B I D Æ.

SILPHOMORPHA SPRETA, sp.nov.

Lata; depressa; minus nitida; supra nigra; labro, mandibulis, antennis, et marginibus lateralibus rufescentibus; elytris magnâ

parte flavis ; subtus (capite nigro excepto), cum pedibus, rufo-picea ; elytrorum epipleuris basi intus late flavis.

[Long. 5 lines, lat. $2\frac{1}{2}$ lines.

The lateral margins of the prothorax and elytra are narrowly, obscurely reddish pitchy ; each elytron bears a large yellow spot which almost reaches both base and apex, and is separated from the lateral margin by only about a fifth of the width of the elytron, its outline next the suture being deeply emarginate ; if the yellow color be regarded as the ground tint of the elytra they would appear to be margined rather widely at the side, and very narrowly in front and behind, with black, and to bear a large common black mark which (viewed with the head of the insect towards the observer) has the appearance of an open umbrella standing up on its handle, the widest part of this mark extending about half-way across each elytron. The head is wide, and short in front of the eyes ; the clypeus is rather deeply emarginate ; on either side of the head a well-defined oblique furrow runs (a little within the eye) from the front nearly to the base,—these furrows converging but not nearly meeting hindward. The surface of the head and prothorax is evenly and finely coriaceous. The latter is slightly and undefinedly uneven on the disc with its front margin strongly bisinuate and its base nearly straight. The elytra have rather wide, and rather decidedly turned up, lateral margins ; their surface is coriaceous uniformly with the head and prothorax, and bears also about eight rows of very faintly impressed punctures. The underside is pitchy much variegated with reddish, the darkest parts being the head, the tibiæ and tarsi, the epipleuræ of the prothorax, the same of the elytra down their middle part, and the hinder part of the hind body. The conspicuous bright yellow color of the inner part of the base of the epipleuræ of the elytra is a striking character.

This species must resemble *S. marginata*, Castln., from the Paroo River, the description of which however (beyond the words “broad, depressed”) deals only with color. In that species

the elytra are said to be yellow at the base, and the comparison of the markings to those of *nitiduloides*, Guér., implies (rather vaguely) that the yellow color almost touches the lateral margins. The description, however, is so vague that *S. spreta* may possibly not resemble it very much.

Northern Territory of S. Australia; collected by Mr. J. P. Tepper; a female specimen.

S. BOOPS, sp.nov.

Supra colore variabilis (ferruginea plus minus infuscata, vel tota picea); corpore subtus antennis palpis pedibusque ferrugineis; capite prothoraceque vix evidenter punctulatis, illo lateribus subdepressis, oculis prominentibus; elytris plus minus punctulato-striatis. Long. 6 lines, lat. $3\frac{1}{2}$ lines.

This species belongs to the very difficult and obscure group in the genus of which *S. fallax*, Westw., is a member. Mr. Macleay tells me that it is distinct from his *S. Mastersi*, which is said to be more strongly punctulate-striate on the elytra than *S. fallax*. The present insect is evidently a very variable one; the series before me varies in the color of the upper surface from nearly uniform ferruginous to nearly uniform piceous, and in the sculpture of the elytra from being nearly smooth to being as strongly punctulate-striate as a typical *S. fallax*. The head and prothorax scarcely differ from the same parts in *S. fallax*, except in the less convexity of the former (especially at the sides), which makes the eyes appear more prominent; and in the latter being wider in proportion to the length of the whole insect, its width being scarcely less than half the whole length. The elytra are decidedly wider in proportion to their length than those of *S. fallax*, being scarcely more than an eighth again (in *fallax* they are about a quarter again) as long as together wide, and the lateral margins are wider, and decidedly more (though still not at all strongly) rounded than in that species.

Northern Territory of S. Australia; collected by Mr. J. P. Tepper.

GNATHAPHANUS DARWINI, sp. nov.

Niger, vix ænescens ; antennis, palpis, pedibusque plus minusve rufescentibus ; prothorace antice minus angustato, angulis pòsticis rotundato-rectis ; elytrorum interstitiis 3° (duplici serie) 5° et 9° seriatim punctulatis. Long. $3\frac{1}{2}$ lines, lat. $1\frac{1}{2}$ lines.

The front of the labrum, the palpi, and the basal joint of the antennæ are brownish testaceous, the remaining joints of the latter being of the same color more or less marked with piceous ; the legs are brown. The surface of the head is even behind the clypeal suture except that there is a puncture in a feeble depression on either side in front, and another near the inner margin of each eye. The prothorax is not quite half again as wide as it is long down the middle, its front margin not much narrower than its base ; its sides are moderately rounded, the flattened margin being very narrow in front, but widening considerably hindward ; the dorsal channel is well marked, the arched impression in front fairly defined, the basal impression on either side shallow, but not small ; the surface is devoid of punctures, except the setiferous one on either lateral margin. The elytra are rather strongly striated, the abbreviated stria rather long and well-defined ; the interstices are flat ; the 3rd interstice bears four large punctures in its front half and two (far apart) in its hinder half close to its outer edge, and also (in its hinder half) close to its inner edge several similar ones ; the 5th interstice bears six or seven (similar) close to its outer edge, and the 9th a somewhat more numerous series interspersed with some smaller punctures.

The double series of punctures on the 3rd interstice seems to distinguish this species from all its allies.

Northern Territory of South Australia ; collected by Mr. J. P. Tepper.

HYPHARPAX PARVUS, Chaud.

I have very little doubt that this is identical with *Harpalus* (*Hypharpax*) *inornatus*, Germ.

CRATOGASTER MELAS, Cast.

The Baron de Chaudoir (Ann. Mus. Gen. Vol. VI., p. 574) has stated that he has examined the original type of this insect, and found it to be identical with *Feronia* (*Cratogaster*) *sulcata*, Blanch. It, therefore, appears to be by an oversight that the two stand in Mr. Masters' Catalogue as distinct.

RHYTISTERNUS SULCATIPES, sp. nov.

Sat depressus; niger; antennis palpis tarsisque elongatis gracilibus plus minus rufescentibus; prothorace vix transverso, postice utrinque bistriato,—striis haud in excavatione perspicua positis, lateribus postice haud sinuatis; elytris striis 5, 6, et 7-a plus minus obsoletis; tarsis posticis extus sat fortiter sulcatis. Long. 7 lines, lat. $2\frac{2}{3}$ lines.

A depressed parallel somewhat slender insect, having much the build of the European *Adelosia picimanus*, Heer. The antennæ and tarsi are longer and much more slender than those of *R. liopleura*, Chaud.; the palpi also are more slender, otherwise the head does not differ noticeably. The prothorax is scarcely a quarter as wide again as it is long down the middle, its base scarcely narrower than its front margin, which is slightly concave, with anterior angles scarcely produced; the sides are moderately and rather evenly rounded, but so that the prothorax is at its widest just in front of the middle (though less in front of the middle than that of *R. liopleura*); they are not at all sinuate behind; the hind angles are very obtuse, but not quite rounded, and not in the least "subdentate" (as they are in *R. liopleura*, Chaud.); the transverse impression on the front of the disc is scarcely marked, the dorsal channel fairly strong but not very nearly reaching either the base or the front margin; there are two well-defined sulci on either side behind, which are not placed in an excavation, but are separated by a space continuous with the general surface of the prothorax; of these the inner one is

linear and sharply cut, the outer more obscure and foveiform. On the elytra the 5th, 6th, and 7th striæ from the suture are progressively fainter than the preceding four, so that the 7th (though traceable throughout with a good lens) is *extremely* faint; in the apical 6th part of the elytra these are as strongly marked as the inner striæ, the 5th being at the extreme base also not much feebler than the 4th. The clearly-defined sulcus on the external side of the hind tarsi is a conspicuous character. The prosternum is not margined between the anterior coxæ. None of the elytral interstices except the 9th are convex unless slightly so close to the apex. The puncturation of the 9th interstice resembles the same in *R. liopleura*. The sculpture of the prosternal episterna is very strong.

The species of this genus (or subgenus) are very close to each other and difficult to identify. The Baron de Chaudoir has described one as having the sides of the prothorax not sinuate behind (*R. liopleura*), and named three other species without describing them (merely pointing out some differences from *liopleura* in respect of two, and from one of those two in respect of the third). The Count de Castlenau has also described most of these under different names from those of de Chaudoir, but his descriptions are of little value, the type of the genus which he used for comparison with other species having been stated by de Chaudoir to have been wrongly named. The insect I have just described differs from the description of *liopleura* (and from specimens which I believe to be that insect) in having the hind angles of the prothorax not in the smallest degree dentate, and the two basal sulci of the same not placed in an excavation, in the external sulcation of the hind tarsi (de Chaudoir gives as a generic character "hind tarsi *generally* not sulcate," and does not mention *liopleura* as forming an exception), and in the very much more slender antennæ and tarsi. From *R. lavilatera*, *R. sulcatipes* differs *inter alia* in not having the 5th, 6th, and 7th striæ on the elytra "altogether obliterated;" from *R. cyathodera* in not having the thorax "much wider and shorter (than that of *liopleura*);" and from *R. misera* in being very much larger, with elytra differently striated, &c.

I may say that Baron de Chaudoir's description of *R. liopleura* appears to me faulty in calling the sides of the prothorax "not" sinuate behind, and the 7th elytral stria "altogether obliterated." The former would be better described as "scarcely sinuate," and the latter as "almost obliterated." I have no doubt of the correctness of this emendation, because the baron states that specimens ticketed *F. Australasiæ* in Castelnau's collection (which species Castelnau speaks of as having the sides of the prothorax sinuate behind) are identical with his *liopleura*; moreover, Castelnau states that this insect (his *F. Australasiæ*, Dej., but, according to Chaudoir, not really that species) is common in South Australia; and there is a *Rhytisternus*, the only one common in South Australia, well known to me, which I had purposed describing as new until I noticed this discrepancy between de Chaudoir's and de Castelnau's descriptions, but which I now have no doubt is the species that de Chaudoir described as *liopleura*, and that de Castelnau called *Feronia Australasiæ*, Dej., and it has the sides of the prothorax slightly sinuate behind, and the 7th elytral stria, though excessively faint, yet certainly traceable with a good lens.

I have specimens of the insect described above from the neighbourhood of Adelaide and from Yorke's Peninsula; it appears to be rare.

PRISTONYCHUS AUSTRALIS, sp. nov.

Minus convexus; subnitidus; niger vel piceo-niger; antennis palpis tarsisque rufo-piceis; elytris subcyaneis; prothorace postice vix angustato, angulis posticis obtusis, subdentiformibus; elytris striatis, striis subtiliter punctulatis; tarsis sat brevibus.

[Long. 7 lines, lat. $2\frac{2}{3}$ lines.

The head and prothorax are nitid, the former with a strong longitudinal sulcus on either side between the eyes. The prothorax is about a quarter again as wide as long, the front margin and base nearly equal in width, the former slightly concave, the latter gently bisinuate; the sides are gently arched in front, and

lightly sinuate behind the middle; the front angles are feebly defined and rounded, the hind angles obtuse but nearly right angles, with the extreme apex however rounded off, and directed somewhat outward; on the surface the anterior transverse impression is strong, the dorsal channel well defined but reaching neither the front margin nor the base, and the basal fovea on either side elongate and extremely deep. The elytra are at their widest behind the middle, their sides gently rounded; they are moderately strongly striated, the striae finely and neither closely nor very noticeably punctulate, the interstices somewhat convex in front, but scarcely so behind; the abbreviated stria near the scutellum on each elytron is long (about equal to the basal two joints together of the antennæ) and very deep, almost foveiform at the apex,—the suture between them being more elevated than behind. The eighth stria bears an irregular row of rather large punctures.

Resembles the European *P. subcyaneus*, Illig., but differs from it *inter alia* as follows:—the prothorax is much less narrowed behind with the hinder part of its sides much less strongly sinuate, the striation of the elytra is feebler, the tarsi are less elongate and not quite so hairy on the upper surface, and the claws are slightly more crenulate on their inner edge.

Port Lincoln, Wallaroo, and near Roseworthy.

CYBISTER GRANULATUS, sp.nov.

♀ Ovalis; depressus; posterius conspicue latior; minus nitidus; supra olivaceus, capite antice prothoracisque lateribus testaceis; elytris crobrius granulatis, margine externo (cum epipleuris) sat late testaceo; subtus piceus, metathoracis episternis abdominisque lateribus testaceo-maculatis; pedibus 4 anterioribus testaceis, femoribus anterioribus fusco-maculatis, tibiis intermediis et tarsis anterioribus fusco-testaceis, tarsis intermediis pedibusque posticis piceis; antennis testaceis. Long. 12 lines, lat. 7 lines (vix).

This species is colored almost exactly as the common widely distributed *C. tripunctatus*, Ol., save that the front tarsi are

darker, and that the dark color of the hind part of the head is rather strongly and angularly produced in the middle into the testaceous color of the front. Its shape, however, is very different, being very much less convex than that of *C. tripunctatus*, with the elytra more dilated behind,—at the widest part behind the middle these are considerably more than half again as wide as at the base,—their sides running in an almost straight line, absolutely from the base, to the widest part and the lateral vitta being of quite even width from base to apex. The head, prothorax, and basal portion of elytra bear a few long irregular scratches. The rows of punctures on the elytra scarcely differ from the same in *C. tripunctatus*, but the general surface of the elytra is more closely and evidently coriaceous so as to appear much less nitid, and is evenly and rather closely studded with small elevated round pustules which, however, become gradually smaller and less elevated from the base to the apex. Immediately within the inner line of punctures, these pustules run in two even parallel rows from the base to the apex, having a narrow smooth space between them. There is some indication of a similar sculpture immediately within the external row of punctures, but these outer rows of pustules leave their line of punctures near the front and bend obliquely across to the base of the inner rows.

Northern Territory of South Australia; taken by Professor Tate.

PALPICORNES.

STERNOLOPHIUS TENEBRICOSUS, sp. nov.

Convexus; minus elongatus; nitidus; niger; antennis, labro antice, palpisque labialibus, rufo-testaceis; supra subtilissime crebre punctulatus; capite prothorace et elytris punctis majoribus seriatim positis (his capillos subtiles ferentibus) instructis; prothorace antice æqualiter emarginato, subtus subtiliter crebre punctulatus, crebre breviter pubescens.

[Long. $5\frac{1}{2}$ lines, lat. $2\frac{1}{2}$ lines (vix).

The basal joint of the maxillary palpi is testaceous, the 2nd and 3rd nearly black, with the extreme apices paler, the 4th reddish pitchy; the anterior tarsi are reddish pitchy. Apart from generic characters, size and color, this insect is so extremely similar to *Hydrobiomorpha Tepperi* that the description of that species will suffice for it, subject to the following remarks:—the prothorax is evenly emarginate in front, without any bisinuation; the punctures forming the series on the head, prothorax, and elytra are evidently finer; and the elytral series are not so regular, the inner four appearing to consist each of two closely adjacent rows confused together, while the series close to the lateral margin is wanting. The general form also is less elongate.

Probably this insect is allied to *S. nitidulus*, Macl., the description of which is rather brief; but that species is said to have the palpi red and to have “faint traces of a few rows of punctures on the elytra.” In *S. tenebricosus* the rows are perfectly well-defined and conspicuous.*

A single example taken near Palmerston, N.T., by Mr. J. P. Tepper.

HYDROBIOMORPHA, gen.nov. (HYDROPHILIDÆ).

Mentum antice leviter rotundatum haud sinuatum, angulis anticis vix emarginatis.

Mandibula apice bilobata.

* Since writing the above I have found in the South Australian Museum a specimen (in wretched condition) which is probably *S. nitidulus*, Macl. It is extremely like *S. tenebricosus*, but differs in having the maxillary palpi red, and the sculpture of the elytra faint and running more regularly in single rows. The sternal spine also differs; in both species it reaches nearly to the apex of the first ventral segment and is pointed behind, but in *tenebricosus* the point forms the apex of the lower edge of the spine (i.e., that nearest to the surface of the body), so that the upper outline of the carina viewed from the side is declivous at the extreme apex; while in the other species this is reversed and the point forms the apex of the upper edge of the spine, so that the upper outline of the carina viewed from the side is straight to the apex.

Prosternum (ut in gen. *Hydroo*) carinâ elevatâ postice spinosâ instructum.

Tarsi postici (nec intermedii) vix remiformes. Maris palpi maxillares fortiter dilatati, feminae gracillimi.

The insects for which I propose this name have very much the appearance of *Hydrobius* at the first glance. They seem to be to some extent intermediate between M. Lacordaire's subfamilies *Hydrophilides* and *Hydrobiides*, having the continuous sternal keel (free at the apex, which is about level with the hindmost edge of the hind coxæ) of the former, with hind tarsi approaching the latter in structure (being narrower and less distinctly remiform than the intermediate tarsi). The following are the leading characters of the genus:—maxillary palpi of male with the joints (especially the third) dilated, of female very long and slender, their second and 3rd joints nearly equal, the 4th only a little shorter; prothorax in front very strongly bisinuate; antennæ very peculiar, 9-jointed, the basal 5 not much different from the same in *Hydrophilus*; the 6th joint smooth and shining like the preceding, but forming a kind of saucer on which the 7th joint is laid in such fashion that very little of the 6th joint can be seen from above, and very little of the 7th from beneath; the 7th joint is almost exactly of the shape of the bone of a chicken known as the "merry-thought;" it (as well as the following two) is opaque and pubescent, and ciliated with long golden hairs; the 8th joint is attached to the apex of the thicker lobe (which lies flat on the saucer-like 6th joint) of the 7th; it (the 8th) is very short, and very strongly produced in an upward direction so as almost to meet the apex of the thinner lobe of the 7th; the apical joint is an arched transverse plate, its upper surface the concave one. The hind body is roundly (not, as in *Hydrophilus*, angularly) convex down the middle line. The mandibles end in two lobes, the external one much the shorter and longer; as far as I can see (without dissection) they are not toothed within.

The carinated prosternum, and claws dentate at their base on all the legs, distinguish this genus from *Tropisternus*; the latter character distinguishes it from *Hydrous* and *Sternolophus*.

H. BOVILLI, sp.nov.

Minus convexa; sat elongata; nitida; nigra; clypeo labroque antice rufis; palpis, antennis (in media) et tarsis rufescentibus; supra subtiliter sat crebre punctulata; capite prothorace et elytris punctis majoribus seriatim positis (his capillos subtiles ferentibus) instructis; subtus subtiliter crebre punctulata, crebre breviter pubescens. Long. $7\frac{1}{2}$ lines, lat. 3 lines.

The head is moderately wide (across the eyes about two-thirds the width of the prothorax); the red anterior margin of both clypeus and labrum is very conspicuous; the puncturation (which covers it and the rest of the upper surface very evenly) is about equally fine with that of the same parts in the European *Hydrous caraboides*, L., but is quite evidently less close; the larger puncturation is as follows:—a pair of punctures placed transversely in front, and about five placed in a transverse row on either side of the base of the dark part of the clypeus; and on either side an elongate cluster just within the eye, and another curving in a half circle forward from just in front of the eye. The prothorax is at the base quite twice as wide as it is long down the middle, and about half again as wide as its front margin; its anterior angles are well advanced and rather sharp, its hind angles roundly rectangular, and its lateral margins nearly straight; the large punctures run in two series on either side obliquely backward from near the front and about the middle of the lateral margin. The elytra are about three and a half times longer than the prothorax, truncate at the base, very gently and arcuately contracted hindward, with humeral angles little marked; the fine lateral margin is continued along the base on either side to the scutellum; the rows of larger punctures run as follows—two rows (very little larger than those of the general surface) near the scutellum on either side, the inner of which in front forks forward into two branches at about twice the distance of the scutellum from the base, and does not reach the apex though both its branches reach the base; then three rows of punctures about

equal in size to those in the prothoracic series, followed by two rows rather close together near the margin; of these rows the 1st and 3rd are not continuous near the base, and all (especially the lateral ones) are somewhat irregular through some of the punctures being out of line.

A single specimen of this very interesting insect has been sent to me by Dr. Bovill, who took it near Palmerston, in the Northern Territory of South Australia.

H. TEPPERI, sp.nov.

Sat convexa; sat elongata; nitida; nigra, clypeo labroque antice rufis; palpis, antennis (articulis ultimis exceptis), tarsis, non nullis exemplis femoribus etiam, rufescentibus; supra subtiliter sat crebre punctulata; capite prothorace et elytris punctis majoribus seriatim positis (his capillos subtiles ferentibus) instructis; subtus subtiliter crebre punctulata, crebre breviter pubescens.

[Long. 7 lines, lat. 3 lines.

Decidedly more convex than the preceding, and much more parallel-sided, the elytra being quite as wide a little behind the middle as at the base; the prothorax is not so strongly bisinuate in front; the puncturation of that segment and of the head scarcely differs from the same in *Bovilli*; the sculpture of the elytra is very different, as the rows of punctures intermediate in size between the uniform surface punctures and the five rows of much larger punctures are altogether wanting. In all other respects the description of the former insect would apply to this one.

Palmerston, N.T. (Mr. J. P. Tepper); also Yam Creek, N.T. (Prof. Tate).

HYDROBIUS.

According to Dr. Sharp (Trans. Ent. Soc., 1884) *H. assimilis*, Hope, which was founded on a specimen from Port Essington, is a common Australian species and is identical with *H. Zealandicus*, Broun (from New Zealand). I am well acquainted with a common and widely distributed (in Southern Australia) species that is

apparently not separable from the New Zealand insect. Dr. Sharp does not *say* that he has examined Hope's type, but I have little doubt he has done so, as the description would hardly suggest the idea of identity with *H. Zealandicus*. I have seen several collections from the Northern Territory containing *Palpicornes*, in none of which were there any examples of the common Southern Australian species, although I have seen a species from that locality very different from it which appeared to me not unlikely to be *H. assimilis*. Assuming Dr. Sharp to be right in his identification (as I have no doubt he is) I offer the following description of *H. assimilis*, Hope, as likely to be interesting to Australian students, who certainly are not likely to identify the insect on Hope's description.

H. ASSIMILIS, Hope.

Nitidus; minus elongatus; piceo-niger; antennis palpis pedibusque rufescentibus; abdomine rufo-maculato; crebre subtilius punctulatus et punctis majoribus seriatim instructus; elytrorum interstitiis planis; subtus crebre breviter pubescens.

[Long. $4\frac{1}{2}$ to 5 lines, lat. $2\frac{1}{4}$ to $2\frac{3}{4}$ lines.

The fine evenly-distributed puncturation of the upper surface is decidedly finer than in the European *H. fuscipes*, Linn.; a row of larger punctures runs across the labrum, another (arched and interrupted in the middle) across the clypeus, and a third curves round the inner margin and front of each eye. On either side of the prothorax two similar lines run from the margin inwards,—one in front of, the other behind, the middle. On the elytra a sutural stria commences faintly about the middle and runs back deepening to the apex: outside this there are nine rows of punctures similar to those of the thoracic series which are obsolete in front (especially those near the suture), but become strongly defined behind; between the 1st and 2nd, 3rd and 4th, 5th and 6th, 7th and 8th of these, and outside the 9th, there is in each case an irregular row of still larger punctures. The red marks on the hind body are not at all conspicuous and consist of

a small spot on either side close to the margin on each of the basal four segments. The metasternum is roundly convex as in *H. fuscipes*; the meso- and pro-sterna are acutely carinate as in *H. oblongus*, Hbst., moderately long cilia springing from each carina. The general form is longer and more parallel than in *H. fuscipes*, with the anterior angles of the prothorax less defined.

A variable insect. The following is, so far as I have seen, about the extreme of its variety:—a little smaller than the type; color a deeper black; no red markings on the underside; the puncturation throughout a little less close; the rows of punctures better defined, all being clearly traceable to the base; the interstices quite strongly convex in their posterior third part. It is possible this may be a good species.

Common in South Australia.

H. MACER, sp. nov.

Nitidus; angustus; convexus; elongatus; olivaceo-niger; antennis palpis pedibusque rufis; prothorace elytris anguste testaceo-marginatis; crebre subtiliter punctulatus et punctis majoribus seriatim instructus; elytrorum interstitiis planis; subtus crebre breviter pubescens, piceo-ferrugineus, obscure rufo-maculatus.

[Long. 4 lines, lat. $1\frac{4}{5}$ lines.

The description of *H. Australis* might be read to apply to this species in all respects except color and shape, the sculpture of the segments presenting no noticeable difference. It is, however, a notably narrower, more convex, and more parallel insect, with elytra very little less than twice as long as together they are wide, while those of *Australis* are scarcely half again as long as wide.

A single specimen in my collection, from Victoria; exact locality not known.

PARACYMUS.

Dr. Sharp (loc. cit.) mentions that he has seen in the collection made by the Count de Castelnau examples of *Hydrobius* (*Paracymus*) *nitidiusculus*, Broun (a species described on New Zealand

specimens), which came from Australia. I have met with a species which agrees very fairly with Captain Broun's description, and as the insect has not yet been described in any Australian publication, the following will probably be of interest to Australian readers. I may add that I can discover only eight joints in the antennæ of this and the two following species, which would associate them with *P. æneus*, Germ., a species for which Dr. Sharp has pointed out in the Ent. M. Mag. (Vol. xxi., p. 112), that a new generic name may be necessary on account of this character. It should be noted also that the two species I have named *Lindi* and *sublineatus* will probably eventually be considered generically distinct from all their allies yet described, since they differ from *Paracymus* in the tendency of the elytral puncturation to run in rows, in the absence of a prosternal keel, and in the shape of the mesosternal keel, which is very peculiar indeed; on the front half of the mesosternum it is non-existent, but in the hinder (almost perpendicular) portion the external margin seems to be formed by a keel which also runs round the rather wide base, and emits from the middle of the latter a central keel which runs forward (down the declivity of the mesosternum) for a short distance. Hence, viewed from above the mesosternum seems to rise from the general surface (not as in *Paracymus* as a sharp point, but) in the form of a transverse ridge, which (on account of the convexity of the mesosternum) is of a curved shape, its convex side being turned forward. The general resemblance to *Anacæna* as well as the inclination towards that genus of the structural peculiarities suggests the probability that other forms intermediate between *Paracymus* and *Anacæna* may yet be discovered; I therefore think it better for the present to regard these insects as forming merely a section of *Paracymus*; to which for convenience of reference the name *Paranacæna* might suitably be applied.

P. NITIDIUSCULUS, Broun.

Breviter oblongus; sat convexus; nitidus; supra æneus; antennis (clavâ piceâ exceptâ), palpis, marginibus lateralibus, et pedibus, plus minus rufescentibus; æqualiter minus fortiter, minus

crebre, punctulatus; elytris (striâ suturali antice abbreviatâ exceptâ) haud striatis; subtus niger, subtiliter coriaceus, brevissime pubescens. Long. $1\frac{1}{2}$ - $1\frac{2}{3}$ lines, lat. $\frac{2}{3}$ line.

There is a considerable variation in the distinctness of the ferruginous tone of the lateral margins of the prothorax and elytra, and in the color of the legs, which are almost black in some specimens. This insect scarcely differs specifically from the European *Paracymus nigro-ceneus*, Sahl., except in respect of its puncturation, which is considerably finer and scarcely so close.

Appears to be common in South Australia; I have it, or have seen it, from Port Lincoln, York's Peninsula and various localities near Adelaide; I have taken it in Western Victoria also.

P. (PARANACÆNA) LINDI, sp.nov.

Breviter oblongus; sat convexus; nitidus; supra nigro-fuscus; capite ad latera ante oculos, palpis, antennis, marginibus lateralibus, et pedibus plus minus dilutionibus; capite subtilius crebre, prothorace sparsius etiam subtilius, elytris fortius vix sublineatim nec crebre, punctulatis; his (stria suturali antice abbreviata excepta) haud striatis; subtus niger, subtiliter coriaceus, brevissime pubescens. Long. $1\frac{2}{3}$ lines, lat. $\frac{2}{3}$ line.

The color varies from that above described to an almost uniform pale brown with the paler parts nearly testaceous. Extremely like the European *Anacæna variabilis*, Shp., in general appearance but differing from it, *inter alia*, in the evidently stronger and more sparing puncturation of the elytra and in the tendency (evident though slight) of the same to run in rows.

Port Lincoln.

P. (PARANACÆNA) SUBLINEATUS, sp.nov.

Breviter oblongus; sat convexus; nitidus; supra niger; antennis (clava excepta), palpis, marginibus lateralibus, et pedibus, plus minus rufescentibus; capite prothoraceque vix evidenter, elytris

sublineatim minus fortiter nec crebre, punctulatis; his (stria suturali antice abbreviata excepta) haud striatis; subtus niger, subtiliter coriaceus, brevissime pubescens.

Long. $1\frac{1}{2}$ lines, lat. $\frac{3}{4}$ line (vix).

Not very much like any other species known to me. Its general appearance at the first glance is much that of an *Anacæna*, but on closer inspection the very feebly punctured head and prothorax, and the very evident tendency of the elytral puncturation to run in rows, give it a distinctive character among its allies. I have seen only a single specimen, and have little doubt that a long series would show as much color variation as in the preceding.

Roseworthy, S. Australia.

PHILHYDRUS LÆVIGATUS, sp.nov.

Ovalis; nitidus; brunneus, capite obscuriore, prothoracis disco et elytrorum sutura infuscatis; antennis palpisque testaceis; his apice vix infuscatis; capite prothoraceque subtilissime, elytris subtiliter, punctulatis; subtus niger, pedibus rufis, femoribus vix infuscatis

Long. $1\frac{1}{2}$ lines, lat. $\frac{3}{4}$ line.

The head is of a dark pitchy color, the clypeus (especially at the sides) paler; the prothorax has a large obscure fuscous cloud in the middle of the disc; the elytra are infuscate along the suture and at a short distance within the margins. In size, shape and coloring of elytra, this species resembles the European *P. marginellus*, Fab., but the head and prothorax (as also the palpi, antennae, and legs) are quite differently colored, and the puncturation of all parts is very much finer; the puncturation (especially that of the head and prothorax) can scarcely be discerned at all under a less powerful lens than a Coddington. There is no indication whatever of any striae on the elytra except the sutural one, which is wanting in the anterior third part.

I took a single specimen in Western Victoria; there is also a specimen in the South Australian Museum, taken by Mr. Tepper

at Border Town, in which the ground color is paler but more suffused with brownish, so that the dark suture is less conspicuous.

HYDROBATICUS AUSTRALIS, sp. nov.

Ovalis; minus convexus; minus nitidus; brunneus, fusco-umbratus; prothorace antice quam postice sat evidenter angustiori; crebre sat fortiter duplo-punctulatus; elytris obscure striato-punctulatis. Long. $2\frac{1}{2}$ lines, lat. $1\frac{1}{2}$ lines.

Head almost wholly testaceous; clypeal suture well defined; front of clypeus decidedly emarginate; surface of head strongly and not very closely punctured; labrum black; palpi and antennæ testaceous, the latter with the club dusky. Prothorax considerably wider than long (as 5 to 3), narrowed from base to apex with gently curved sides; base about half again as wide as apex, the former nearly straight, the latter slightly emarginate; hind angles slightly marked, obtuse; front angles quite rounded off; surface reddish testaceous with some fuscous markings the most conspicuous of which are two longitudinal lines placed in the hinder half one on either side of the middle, closely and rather strongly punctured (the punctures of different sizes confusedly mixed together). Elytra rounded at the apex, each with about 10 rows of punctures placed in scarcely impressed striæ, the punctures very closely packed in the rows; the interstices quite flat and confusedly studded with punctures similar to those in the rows, and also (in about equal numbers) with much smaller punctures. The underside is black, very minutely and closely punctured; the femora are black, the tibiæ and tarsi reddish.

Somewhat variable in color. I have seen specimens, which I cannot separate specifically, with the legs and the whole upper surface testaceous except the two dark lines on the prothorax which are equally well defined in all the specimens I have seen, and therefore more conspicuous in the lighter-colored examples.

Apparently common throughout South Australia; I have it also from Victoria.

N.B.—This insect no doubt resembles *H. tristis*, Mael., and *luridus*, Mael., (from Queensland), but differs in having the thorax decidedly wider at the base than in front, and doubtless in other particulars. Mr. Macleay has done me the favor of looking at this insect and informing me that it is distinct from the two he has described.

HYGROTOPHUS NUTANS, Mael.

I should say that M. Fairemaire is quite mistaken in thinking that his *Berosus externespinosus* is identical with this insect. I have specimens before me which I believe to be *H. nutans*. From the description it would appear to be a much smaller insect than *B. externespinosus*, and covered with pubescence. If I am right in my identification I cannot regard the verticality of the head or the rounded basal outline of the thorax as a satisfactory generic character. The former depends much on accident (I have specimens of typical *Berosus* before me with the head so declivous as to be quite vertical), and the latter is a mere question of degree. At the same time the insect has a very distinctive appearance, and does not seem at home in *Berosus*. Structurally I can see very little to distinguish it, but its hind tarsi much narrower on their widest face than their tibiae, together with the dense pubescence of the elytra, and the transverse nature of the prothoracic sculpture are very noticeable characters. In the specimens before me the thorax is not *much* more rounded behind than that of some species of *Berosus*. I believe the genus to be a good one.

BEROSUS MAJUSCULUS, sp.nov.

Oblongo-ovatus ; convexus ; supra testaceus ; palpis apice, capite postice, prothoracis disco, et elytris, plus minus fusco-nigro-notatis ; subtus (capite antice, prosterno in parte, abdomine nonnullis exemplis postice, et pedibus, pallidis exceptis) niger ; capite prothoraceque fortius minus crebre punctulatis ; elytris apice emarginatis, punctulato-striatis, interstitiis planis subtilius nec crebre punctulatis.

Long $2\frac{1}{2}$ -4 lines, lat. $1-1\frac{1}{2}$ line.

Compared with the European *B. spinosus* this insect is more elongate (with the elytra at their widest very evidently behind the middle and much more elongated to a point behind), the puncturation of the head and thorax is a little finer and not nearly so close, and the striæ on the elytra are a little stronger.

The color is rather variable; the head is usually yellowish-brown, becoming darker behind, but in some examples the clypeus is pale lemon yellow and in others there is hardly any posterior infuscation; the prothorax is yellowish-brown, generally with an elongate dark vitta on either side of the middle; the elytra are very pale fuscous, clouded with a much darker tinge, except along the lateral margins and at the apex,—generally to such an extent that the ground colour is more or less overborne, the darker shade here and there forming rather distinct large blotches. The sculpture of the elytra is quite uniform, not becoming feebler either laterally or apically. The elytra are drawn out considerably at the apex, the apex itself being more or less strongly emarginate, the sides of the emargination being about equal and more or less sharply pointed. The underside is rugosely finely and very closely, but not deeply, punctured. A carina runs along each of the sterna; on the metasternum, however, it is very feeble and is cleft to form the sides of a small smooth central slit; the elevated flattened central space of the metasternum is very well defined and sharply pointed behind, its point projecting considerably between the hind coxæ. In the female the hind body of dried specimens is of very small size, its plane is very much below that of the metasternum not filling up a quarter of the space included in the cavity of the elytra, its apex bears two long testaceous filaments, its ventral segments are of even length (or nearly so) all across, and the antepenultimate is about the same width as the penultimate. In the male the hind body is much larger and has no apical filaments, its third and fourth ventral segments are much longer at the sides than in the middle, and the fifth is very much longer in the middle than the fourth, the hind margin of the fifth segment, moreover, being raised into a prominence on either side of the middle, and each of these prominences running backward

on the segment as a scarcely defined carina, the intervening space being flattened. The base of the femora is sculptured as in the following species, but the part so sculptured being unicolorous with the rest of the surface, is less noticeable.

Two Australian species of *Berosus* with elytra apically emarginate have been previously described, *Australice*, Muls., and *externespinosus*, Fairm. *B. majusculus* differs *inter alia* from the former of these by the striae and puncturation of its elytra being even over the whole surface (or perhaps slightly stronger near the apex), from the latter by the equality of the apical points of the elytra (which, however, may be a variable character) and by its unicolorous legs.

Widely distributed in South Australia; I have seen specimens from Port Lincoln, Adelaide, and Sedan.

B. GRAVIS, sp.nov.

Oblongo-ovatus; convexus; supra testaceus; palpis apice summo, capite postice prothoracis disco, et elytris, plus minus fusco-nigro-notatis; subtus (capite, et prosterni lateribus, pallidis exceptis) piceus vel nigro-fuscus; capite antice sparsius subtilius postice gradatim crebrius fortius, prothorace fortius etiam sparsius, punctulatis; elytris apice emarginatis, punctulato-striatis, interstitiis planis subtilius nec crebre punctulatis; pedibus testaceis femoribus 4 posterioribus basi nigris.

[Long. $3\frac{3}{4}$ - $4\frac{1}{4}$ lines, lat. $1\frac{3}{4}$ -2 lines.

This fine large species is closely allied to *B. majusculus* from which it scarcely differs in the color and markings of the upper surface. On the underside its entirely testaceous head and the four hinder femora nearly black in their basal two-thirds distinguish it. In respect of sculpture the front part of the head is much more finely punctured than in *B. majusculus*, the remainder of the sculpture presenting little distinction. The head is proportionately much narrower and more elongate. In the male the dilated joints of the anterior tarsi are much wider, and the surface

and hind margin of the 5th ventral segment are quite simple. In the females that I have seen the apical filaments are wanting, but they may have been accidentally broken off. From *B. Australiæ*, Muls., this insect may be known by its elytral sculpture not becoming feebler near the apex; and from *B. externespinosus*, Fairm., by the two apical spines of each elytron being about equally developed.

In various localities in South Australia, Finniss River, Murray Bridge, &c.

B. DECIPiens, sp.nov.

Oblongo-ovatus; convexus; supra testaceus, palpis apice vix infuscatis; prothorace fusco-irrorato, antice vix infuscato; elytris fusco-irroratis et maculatis; subtus ferrugineus, femoribus abdomineque fusco-notatis; capite prothoraceque æqualiter sparsim sat subtiliter punctulatis; elytris apice leviter emarginatis, punctulato-striatis, interstitiis planis sat fortiter punctulatis.

[Long. $3\frac{1}{2}$ lines, lat. $1\frac{2}{3}$ line.

Resembles *B. majusculus*, but with the puncturation of the head and prothorax very much finer and more sparing. The punctures are of a fuscous color, but otherwise those parts are almost unicolorous. The sculpture of the elytra is scarcely feebler near the apex than in front; their apex is only minutely emarginate, with the sides of the emargination scarcely spiniform (probably a variable character), and their infuscation is very undefined, showing no tendency to be concentrated into a fascia. On the underside the punctured part of the femora is infusate, and the segments of the hind body are transversely marked with blackish-brown. The specimen before me is a female, and presents no very conspicuous sexual character that I can find beyond the slenderness of the front tarsi. The fine sparing puncturation of the head and prothorax (a little finer on the clypeus but otherwise even in distribution and intensity) seems the most distinctive character of this insect amongst those of its Australian allies that have the elytra emarginate at the apex. From *B. Australiæ*, Muls., (in the description of which the puncturation of those parts is not

mentioned), it seems to differ widely in color and markings, also in having (so far as the example before me is concerned) the elytra not distinctly spined at the apex, and striæ 4-6 of the elytra not differing from the rest.

Taken in the Northern Territory of South Australia by Mr. J. P. Tepper.

B. DUPLO-PUNCTATUS, sp. nov.

Ovatus; sat brevis; fortiter convexus; supra fuscus, capite et prothoracis disco æneis, cupreo vel aureo micantibus, elytris nigro punctulatis et maculatis; subtus niger, palpis (apice excepto), antennis, pedibus (femoribus 4 posticis basi exceptis), et prosterni lateribus, testaceis; capite prothoraceque rugose fortiter crebre (huic interstitiis subtiliter perspicue) punctulatis; elytris apice rotundatis, fortiter crenato-striatis, interstitiis subconvexis subfortiter nec crebre punctulatis.

[Long. $2\frac{1}{2}$ -3 lines, lat. $1\frac{1}{3}$ - $1\frac{2}{3}$ line.

An extremely convex species; viewed from the side the elytra appear considerably more than half as high (*i.e.*, from the level of the lateral margin to that of the suture) as long. The blotches on each elytron are as follows: one on the shoulder, two down the suture almost touching it, and one near the lateral margin, but in some examples they are ill-defined, and in some examples some of them are wanting; the striæ and punctures on the elytra are blackish. Compared with the European *B. luridus*, Linn., this species is even more convex (especially about the hinder part of the elytra), its head and prothorax are more coarsely punctured; its scutellum is more elongate, and the elytral interstices are a little more convex. It differs from *B. luridus* also in the absence of any raised line on the prothorax, and in the presence on that segment of a system of very distinct (though small) punctures interspersed among the larger ones. The puncturation of the underside is close and fine, but rugose. The sternal keel is traceable only on the mesosternum (which is more declivous than in *B. luridus*), where, however, it is extremely sharply elevated, its hinder edge being truncated and standing out between the intermediate legs much above the level of their coxæ (a similar

structure but less developed is seen in *B. luridus*). The flattened space on the middle of the metasternum is somewhat trapezoidal, having its narrowest end directed backwards, but not at all passing the front margin of the hind coxæ, and bearing a large fovea in the centre. The basal third part of the lower face of the four posterior and (obsoletely of the anterior) femora (as in *B. luridus*) is nearly black and is opaque, densely and very finely punctulate, and minutely pubescent. My three specimens are of the same sex, apparently female; the 5th ventral segment is widely and somewhat squarely emarginate at the apex, each side of the emargination forming a strong spine; the 6th segment is barely discernible, projecting from the crenulated base of the emargination.

Probably allied to *B. ovipennis*, Fairm., (from Queensland), but much larger, without elevated or impressed lines on the head, with elytral interstices not flat, &c., &c.

Adelaide and Port Lincoln.

B. DISCOLOR, sp.nov.

Oblongo-ovatus; convexus; supra testaceus; capite et prothoracis macula postica nigro-viridibus, elytris fusco-maculatis; subtus niger; palpis (apice infuscato excepto), antennis, prosterni lateribus, et pedibus testaceis; capite rugulose subtilius confertim, prothorace fortius sparsius haud rugulose, punctulatis; elytris minus fortiter punctulato-striatis, interstitiis planis confuse sparsius punctulatis, apice leviter spinoso.

[Long. 2 lines, lat. 1 line (vix).

In my type of this insect the prothorax is yellowish testaceous, while the color of the elytra inclines to pale fuscous. The spot on the prothorax is transverse, and occupies the middle third part of the surface being about half as long as the whole segment, and placed just in front of (but not touching) the base. On each elytron there is an elongate fuscous spot on the first interstice at about a quarter of its length from the base, a larger and blacker

one spreading out on the 2nd interstice a little less than half-way from the former to the apex, and a third close to the lateral margin at about half its length; the punctures and striæ are dark fuscous or black. The puncturation of the head is rugulose but very fine and close (much more so than in *B. duplopunctatus*), that of the prothorax smooth and neither strong nor close (not unlike that of *B. majusculus*). The elytral sculpture resembles that of *B. majusculus*, except that the interstices are much more closely punctured; the whole organs too are considerably less drawn out towards the apex than in that species, the apex itself being not emarginate but produced in a short sharp spine. The underside of the male closely resembles that of *B. majusculus*, except in having the whole undersurface of the head black or nearly so, and the hind margin of the metasternum less produced backward. The palpi are not narrowly tipped with black as they are in *B. majusculus*, but are rather strongly infusate in the apical two-thirds of the last joint.

I possess a single example (also a male) from the same locality as that described above, which differs from the type in being slightly smaller, and of darker color, with a somewhat foveiform impression at the middle of the clypeal suture, and also in being somewhat more coarsely sculptured throughout, the elytral interstices especially being less flat and more strongly punctured; as the specimen is not in very good condition and the differences are all rather slight, I abstain from bestowing a new name upon it, but I think it can hardly be regarded as a mere variety of *B. discolor*.

The unispinose apex of the elytra will distinguish *B. discolor* from all the hitherto described Australian species of *Berosus*, unless it be *B. sticticus*, Fairm., the elytra of which are stated to be "obtusely acuminate behind;" but even if this expression indicates a similarity in the apex of the elytra, the head of *B. sticticus* is said to be "almost impunctate in front" while that of *B. discolor* is punctured over its whole surface more closely than in any other *Berosus* known to me.

Port Lincoln.

B. FLINDERSI, sp.nov.

Oblongo-ovatus ; convexus ; supra testaceus, capite prothacisque disco æneis vel nigroæneis ; elytris fuscis nigro maculatis ; subtus niger, palpis (apice anguste nigro excepto), antennis, prothoracis lateribus et pedibus testaceis ; capite prothoraceque crebrius sat fortiter punctulatis ; elytris fortiter punctulato-striatis, interstitiis subconvexis fortius nec crebre punctulatis, apice sat acutis.

[Long. $1\frac{2}{3}$ line, lat. $\frac{4}{5}$ line.

I have examined many specimens of this insect without finding any tendency to vary in size. The brassy spot on the prothorax occupies the whole disc save that the anterior margin, or base, or both, may be narrowly testaceous. The black spots on the elytra are placed much as in *B. discolor*, but generally that near the lateral margin is alone conspicuous, the others being almost lost in a fuscous cloudiness that suffuses the entire disc. The head and prothorax are rather evenly and moderately strongly and closely punctured ; the latter bears traces of the basal end of a longitudinal channel, and the former is a little foveated at the middle of the clypeal suture. The striæ on the elytra are nearly as deep as, and the interstices not much less convex than, those of *B. duplopunctatus*, the latter being punctured scarcely less strongly than the prothorax. In the male the fifth ventral segment is somewhat roundly truncate, in the female it is roundly emarginate in a somewhat upward direction, and two filaments (broken off in most examples) project from the apex of the very small sixth segment. In both sexes there appears to be a very minute triangular excision in the middle of the apical margin of the fifth segment.

The resemblance of this insect to the European *B. luridus* is extremely close. It is much smaller and somewhat more elongate, and less convex. In color and sculpture there is scarcely any difference except that the punctures in the elytral striæ are smaller and closer. The sexual characters, however, differ considerably, and the mesosternal carina is of somewhat even prominence, not raised up at the hinder apex (as it is in *B. luridus*) into a free erect process. The femora are sculptured at their base as in *B. duplopunctatus*.

The species of *Berosus* described by M. Fairemaire, are all said to have their elytra either "emarginate," or "obtuse" at the apex, with one exception,—*B. sticticus*,—in which however the front of the head is said to be impunctate ("lisse").

Not rare near Port Lincoln.

B. SIMULANS, sp.nov.

Oblongo-ovatus; convexus; supra testaceus; capite prothoracisque macula nigro-æneis, elytris vix fusco-maculatis; subtus niger, antennis palpis pedibusque testaceis; capite crebre, prothorace sparsius, fortiter punctulatis; elytris sat fortiter striatis, striis punctis magnis nec profundis instructis, interstitiis vix convexis fortiter nec crebre punctulatis, apicibus separatim spinoso-acuminatis. Long. $1\frac{1}{2}$ line, lat. $\frac{3}{4}$ line (vix).

Resembles the preceding, but the head is more, and the prothorax less, closely punctured. The punctures in the elytral striæ are long and shallow. In the example before me the elytra are separately pointed in the form of a small acute spine, but the value of this character is doubtful, as I find some variety in the form of the apex of the elytra in most species of *Berosus* of which I have seen numerous specimens. In one specimen of *B. Flindersi* the apex of one elytron is much more acute than that of the other. The example before me is a male; it is pinned in such fashion that I cannot bring a strong lens to bear on its ventral segments, but as far as I can see the 5th ventral segment is gently emarginate, the middle of the emargination being thickened, and its sides slightly pointed. The palpi are entirely testaceous, while in *B. Flindersi* they are conspicuously infuscate at the apex. The dark mark on the prothorax is not very sharply defined and occupies the hinder half of the disc—but is probably variable.

In the Adelaide University Museum; taken in fresh water near Rivoli Bay.

HYDROCHUS ADELAIDÆ, sp.nov.

Sat elongatus; brunneus, capite prothoracisque obscurioribus, palpis (apice excepto) antennis pedibusque testaceis, tarsorum

apice nigro ; capite prothoraceque fortiter rugulose punctulatis ; hoc vix inæquali ; elytris crasse profunde seriatim punctulatis, interstitiis vix conspicuis. Long. 2 lines (vix), lat. $\frac{1}{2}$ line.

The clypeus is nearly black, shining and not very closely, strongly or roughly punctured, the clypeal suture fairly defined and a little angulous behind, the hinder part of the head obscurely and very roughly punctured. The prothorax is punctured as the hinder part of the head ; it is slightly wider than long, nearly twice as wide in front as behind, its sides are gently rounded in the front two-thirds, nearly straight behind, and owing to the coarseness of the sculpture they appear to be strongly crenulate ; the surface bears a vague elongate impression on either side near the posterior angles with an obscure rounded impression close in front of its anterior end. The elytra are at their widest behind the middle ; their shoulders are quite rounded off ; their sculpture consists of ten rows of round deep foveæ, the foveæ near the base, apex and lateral margins smaller than the rest ; the rows are not very regular and the intervals between them are not longitudinally continuous, being in width and prominence similar to those separating fovea from fovea in the rows ; the sutural line is very elevated.

I know no other species closely resembling this, but in order to make a comparison I may say that, placed beside the European *H. angustatus*, Germ., independently of color, the prothorax is wider in front and shorter, and the elytra are much wider behind with very much less regular and coarser puncturation.

I have a single specimen taken in the River Torrens near Adelaide.

H. REGULARIS, sp. nov.

Elongatus ; brunneus, capite prothoraceque obscurioribus, antennis pedibusque brunneo-testaceis, tarsorum apice piceis ; capite prothoraceque fortiter rugulose punctulatis ; hoc inæquali ; elytris fortiter seriatim punctulatis, interstitiis manifeste notatis.

[Long. $1\frac{3}{5}$ lines, lat. $\frac{2}{5}$ line.

The whole of the head is uniformly punctured, and there is a well-defined narrow longitudinal furrow between the eyes. The prothorax is much more coarsely and less closely punctured than the head; it is decidedly transverse and not very much wider in front than behind; its sides are only slightly rounded in front, scarcely sinuate behind, and with very little appearance of crenulation; its surface is uneven in a manner very difficult to define, —from the centre of the base an obscure rib runs forward about a third the length of the segment, and then forks into two branches which run obliquely for a short distance towards the anterior angles and then turn towards the front margin and fade into the general surface, from the point where they turn forward a similar rib being given off on either side which runs back in a slight curve nearly to the base half-way between the central rib and the posterior angles; the spaces among and immediately outside all these ribs are obscurely depressed. The elytra are very slightly at their widest behind the middle; their anterior margin is very strongly defined, their suture strongly elevated; each of them bears ten very regular rows of square, and deep, but not very large punctures, the intervals between the rows being well defined, the intervals outside the middle a little the most conspicuous.

Compared with the preceding this is a narrower and more parallel species, with defined inequalities on the prothorax, and elytra very much more finely punctured, the punctures in even rows and the interstices between the rows regular. The elytral sculpture is not unlike that of *H. angustatus*, Germ., but the interstices between the rows are narrower and more defined.

I have a specimen of this insect from Murray Bridge, and another from Western Victoria.

H. VICTORIÆ, sp. nov.

Sat elongatus; piceus, antennis, palpis pedibusque dilutioribus, tarsorum apice nigris; capite prothoraceque fortiter rugulose punctulatis; hoc vix inæquali; elytris fortiter confuse sculpturatis, interstitiis alternis sat fortiter elevatis.

[Long. $1\frac{2}{3}$ lines, lat. $\frac{3}{8}$ line.

The head and prothorax are coarsely and very rugosely sculptured, the clypeal suture fairly defined, the prothorax with an ill-defined impression across the middle, which widens into a vague fovea on either side. The prothorax is equally long and wide, its front margin nearly twice as wide as its base, its sides strongly rounded, their edges (owing to the coarseness of the sculpture) appearing crenulate. The elytra are considerably dilated to behind the middle; their puncturation is very ill-defined, owing to the roughness and irregular elevation of the interstices between puncture and puncture in the rows which almost obliterate the interstices between the 1st and 2nd, 3rd and 4th, &c., rows; the interstices between the 2nd and 3rd, 4th and 5th, &c., rows are well-defined and keel-like in front, but become fainter behind, that between the 4th and 5th being the strongest and most continuous; the sutural line is well elevated.

A very distinct species. The punctures in the rows on the elytra are about the same size as in *H. regularis*, but are very much less distinct, the spaces between the raised alternate interstices appearing irregularly transversely ribbed (or from some points of view almost tuberculate) rather than distinctly biserially punctulate.

I have two specimens taken at Ararat, Victoria.

OCHTHEBIUS AUSTRALIS, sp. nov.

Sat latus; nitidus; antennis, palpis, pedibus et prothoracis marginibus plus minus testaceis; capite et prothorace fortiter inæqualibus vix perspicue punctulatis; elytris fortiter æqualiter punctulato-striatis.

Long. $\frac{4}{5}$ -1 line, lat. $\frac{3}{10}$ - $\frac{2}{3}$ line.

The clypeal suture is arched and very deep; the portion of the head behind it is sculptured in such fashion that there appear to be (when looked at from directly in front) a raised space at each corner and another in the centre, into which the surface is divided by extremely deep channels. The prothorax is decidedly transverse, of equal width in front and behind, with strongly explanate

margins, the margin on either side of nearly even width and scarcely narrower than half the width of the disc; the middle of the disc is occupied by a very strong dorsal channel, on either side of which an equally strong impression runs from close to its base obliquely forward to about the middle of the lateral ridge of the disc; there is also a strong foveiform impression on either side just within the anterior corner of the disc; the surface of the explanate margins is noticeably but less definedly uneven; their hinder third part (or rather more) is membranous; their outline (inclusive of that of the membrane) is gently and evenly convex; the anterior angles are well-marked, sharp, and minutely pointed forward; the hinder angles of the membrane are scarcely defined. The surface of the elytra is not quite even and is marked with well-defined coarsely punctate striæ, which are scarcely enfeebled behind; the interstices are moderately convex and impunctate, the apex of the elytra is moderately pointed. The underside is rather shining, and I cannot find that it bears any distinct puncturation. I do not observe any notable sexual differences in the structure of the ventral segments.

No Australian species of this genus has been described hitherto, so far as I know. Of European species *O. bicolon*, Germ., is the one that *O. Australis* seems more particularly to resemble. Compared with it (apart from the difference in size), the maxillary palpi of *O. Australis* are much shorter and less stout, the inequalities on its head and prothorax are more strongly defined, its prothorax is not (or scarcely) punctulate, the sculpture of the elytra continues, without becoming obsolete, to the apex.

I have taken this little insect in the River Tod near Port Lincoln and in the Torrens near Adelaide.

HYDRENA TORRENSI, sp. nov.

Oblonga, postice minus dilatata; supra obscure livida, capite piceo; clypeo subtiliter, capite postice prothoraceque sat fortiter, punctulatis; hoc transversim et longitudinaliter biimpresso;

elytris subtiliter striato-punctulatis (striis, nec puncturis, postice obsoletis) apice separatim acuminatis; subtus nigra, antennis palpis pedibusque lividis. Long. 1 line, lat. $\frac{2}{3}$ line.

The difference between the puncturation of the clypeus and of the rest of the head is very noticeable. There is an obscure longitudinal depression on either side between the eyes. The head behind the clypeal suture is punctured very similarly to the prothorax, rather coarsely and deeply but not very closely. The prothorax is decidedly transverse by measurement, but to the eye only very slightly so, its front margin decidedly narrower than its base; its puncturation (especially when viewed obliquely from the side) seems to run in longitudinal wrinkles; two transverse depressions run from one lateral margin to the other, dividing the surface into three nearly equal spaces; a transverse depression also runs obliquely from just within the posterior angle on either side to the front margin, so that the entire surface is divided by these four depressions into nine spaces, of which the three down the middle are much larger than the rest; the sides are moderately arched, their greatest divergence from each other being behind the middle, where they are angulated rather than regularly rounded; the anterior corners of the prothorax are rectangular, and not at all produced forward; the basal angles are similar, but perhaps a trifle sharper. The elytra are finely and closely, but very distinctly, punctulate-striate, and furnished with fine and obscure pubescence which runs in rows along the striæ; the interstices are flat or nearly so, and do not show any defined puncturation under a Coddington lens; the striæ fail near the apex, but the puncturation continues of even intensity, though it becomes somewhat confused.

The underside is opaque and minutely coriaceous, the hind body covered with minute obscure pubescence. If I have both sexes the sexual differences are slight. The basal four ventral segments are short and equal, the fifth much longer. The latter is traversed by a very fine arched keel which commences on either side of the apex, and runs backward in a curve so as almost to

touch the apex of the fourth segment in the middle. In what I regard as the female there is a very small sixth segment bearing two short apical setæ; in the other sex (as I take it to be) this segment is a little larger and without apical setæ, but these differences may be accidental.

This species appears to be somewhat variable; I possess specimens differing from the type described in having the puncturation of the prothorax considerably obliterated on the middle of the disc, and the angulate appearance of the sides of the same segment only feeble.

Probably allied to the Queensland *H. acutipennis*, Fairm., but differing from it considerably in the sculpture of the prothorax, in having the part of the head behind the clypeal suture punctured similarly to the prothorax, and in having the elytral striæ not "scarcely growing obsolete at the apex," but altogether disappearing before the apex. From *H. luridipennis*, MacL., it seems to differ in having the thorax transverse with its angles not acute.

Placed beside the European *H. angustata*, Sturm, the general form is shorter and broader, the prothorax is evidently more transverse with its surface rendered much more uneven by transverse and longitudinal depressions, the elytral striæ much more obsolete behind, and the elytra separately pointed instead of being rounded off. The puncturation does not differ much.

Near Adelaide; in the river Torrens.

N.B.—In the South Australian Museum there is a specimen of *Hydraena*, taken in Victoria by Mr. Tepper, which I refer with some doubt to this species. The elytra appear a little more strongly striated in front, and at the apex are much less acute, being separately *rounded* rather than distinctly acuminate. The hind tibiæ, moreover, are bisinuate on their inner edge; this latter may be merely a sexual character. In all other respects the two insects seem to be quite identical.

VOLVULUS PUNCTATUS sp.nov.*

Elliptico-ovalis ; sat nitidus ; niger ; antennis, palpis et pedibus anticis testaceis ; pedibus 4 posterioribus et abdominis lateribus plus minus rufescentibus ; capite subtilius minus crebre, prothorace subtilius (disco sparsim, lateribus crebre), elytris fortius (disco sparsim, lateribus crebre) punctulatis ; elytrorum margine leviter bisinuato. Long. $2\frac{1}{4}$ lines, lat. $1\frac{1}{4}$ lines.

Compared with *V. scaphiformis*, Fairm., (I have little doubt that my specimen is correctly referred to it ; it is certainly at least very closely allied) the color of the present insect has no metallic tinge, the shape is very much wider and more rounded on the sides, the elytra are without any trace of the striæ except a sutural stria in the hinder half, and the edge of the elytra is lightly bisinuate instead of being gently concave along the whole length.

There are several specimens in the South Australian Museum, but without any record of particulars of capture.

CYCLONOTUM AUSTRALE, sp.nov.

Late ovatum ; nigrum ; antennis, palpis, tarsisque piceis vel rufescentibus ; creberrime punctulatum ; elytris striâ suturali impressa. Long. 3 lines (vix), lat. $1\frac{3}{8}$ lines.

The resemblance of this species to the common European *C. orbiculare*, Fab., is so close that it would seem to be sufficiently described by the statement that it is much larger than that insect, with the palpi of a paler, and the legs of a darker, color, and the puncturation of the elytra slightly finer. Mr. Macleay has done me the favor of comparing it with his *C. Mastersi*, and tells me that it is a larger insect than his, and that its puncturation is coarser.

* In some respects (e.g. the very deep insertion of the prothorax in the front emargination of the elytra) this insect seems referable to *Globaria*, but it has not the pencil of long hairs at the apex of the hind tibiæ which are said to be characteristic of that genus.

Probably widely distributed in South Australia, but apparently not common. I have taken it near Adelaide, and it has been taken near Port Lincoln by Mr. J. Anderson.

CERCYON FOSSUM, sp.nov.

Breviter ovale; convexum; nitidum; piceum; antennis palpis pedibusque rufescentibus; capite prothoraceque sparsim subtiliter punctulatis; elytris striatis; striis crasse fortiter nec crebre, interstitiis subplanis sparsim subtilius, punctulatis.

[Long. 1 line, lat. $\frac{3}{5}$ line.

This species does not very closely resemble any European *Cercyon* known to me, owing to the very coarse wide-set punctures in its elytral striæ. Placed beside *C. flavipes*, Fab., it is seen to be wider in proportion to its length (especially behind), with the puncturation of the head and prothorax very much more sparing and less noticeable; the punctures in the striæ on the elytra look large enough to allow the thin end of the claw-joint of the tarsi to be inserted into them, and are placed in the striæ with a well-defined interval between puncture and puncture. The interstices between the striæ are almost quite flat in front but become evidently convex near the apex; they are punctured sparingly but not very finely. The general surface of the underside is opaque, very finely punctulate, the metasternum being nitid and coarsely and sparingly punctulate. The sparing puncturation of the head and prothorax will in itself distinguish this insect from *E. dorsale*, Er. The tarsi are stouter, the basal joint of those of the hind legs shorter, than usual in the genus.

S. Australia.

C U C U J I D Æ.

LÆMOPHLÆUS DIFFICILIS, sp.nov.

Planus; nitidus; vix pubescens; testaceus; fronte æquali; prothorace vix transverso, utrinque fortiter striato, angulis anticis dentatis.

Long. 1 line, lat. $\frac{4}{5}$ line.

The head behind the clypeal suture is quite smooth without any impressions whatever, and is sparingly and moderately

strongly punctured. The prothorax is equally long and wide, at its widest across the front margin where its angles are dentate, and thence contracted with a very slight curve to the base, the anglet at which are obtuse; the fovea on either side of the disc is wide and strong, especially behind; the surface between the foveæ is very flat and is finely and sparingly punctured; the space outside the fovea is rather strongly declivous, and is punctured more strongly than the disc. The sculpture of the elytra seems to consist of two costæ (the innermost very narrow and obscure), which are about the 3rd and 5th interstices among a series of very obsolete punctured striæ. The scutellum is rather strongly transverse. The antennæ in the male are a little longer than in the female, about equal to the length of the elytra; the basal joint rather long and stout (very evidently longer than wide), the 2nd narrower and considerably shorter, but wider than the remaining joints of which the next six are equal to each other in length and thickness, the apical three longer but scarcely thicker.

Allied to *L. testaceus*, Fab., but differing *inter alia* in the perfectly even surface of the head behind the clypeal suture, and the sparing puncturation of the prothorax. A few specimens under bark of a felled *Eucalyptus*, about 30 miles north of Port Lincoln.

L. LINDI, sp.nov.

Minus planatus; sat nitidus; vix pubescens; testaceus; fronte subtiliter canaliculata; prothorace vix transverso utrinque subtiliter bistriato, sat crebre punctulato; angulis anticis obtusis.

[Long. $\frac{9}{10}$ line, lat. $\frac{4}{15}$ line (vix).

The puncturation of the head is faint and not very easy to see clearly, but it is moderately close and has a tendency to run in longitudinal wrinkles; the longitudinal furrow on the forehead is moderately well-defined and does not reach the clypeus or the back of the head. The prothorax is evenly (though of course not strongly) convex, and is about as long as wide; its front angles are quite obtuse, the basal ones rather sharp; the base is nearly as

wide as the front margin, the sides being very gently arched; the striæ on either side of the disc are extremely fine and very close together, the external one scarcely continuously traceable; the punctures on the disc are fine and moderately close, with a little tendency to a longitudinal serial arrangement. The sculpture of the elytra scarcely differs from that of the preceding species except that the 7th interstice is costiform, whereas in *L. difficilis* it is scarcely so. The scutellum is rather strongly transverse. The antennæ in both the specimens before me are very stout and reach back a little beyond the base of the prothorax; their joints differ *inter se* very little in respect of width, the 1st being a little wider than the 2nd, and the second slightly wider than the next 6, the 9th and 10th a little widest of all, the 11th rather elongate.

Allied to *L. bistriatus*, Grouvelle, but differing in the much closer puncturation of the prothorax, the grooved forehead, &c., &c.

LAMELLICORNES.

BOLBOCERAS KIRBII, Westw.

In Mr. Masters' "Catalogue of Australian Coleoptera" this appears as a distinct species. Prof. Westwood, however, in a note to his description of it states that after his description was in type he became possessed of evidence that it is only a variety of *B. proboscideum*, Schreibers,—and I believe his opinion has not since been controverted.

B. TATEI, sp. nov.

Nigro-piceum; clypeo antice leviter rotundato, fronte cornu elongato erecto simplici, antice basi carina fortiter rotundata instructo; prothorace lateribus et in foveolis lateralibus rugoso, præterea lævi, retuso, utrinque cornu brevi acuminato porrecto; parte retusa permagna profunde excavata sparsius nec fortiter punctulata, intus marginem versus aureo-hirsuta; elytris leviter punctulato-striatis; tibiis anticis 5 dentatis ♂.

[Long. $8\frac{1}{2}$ lines, lat. $4\frac{1}{3}$ lines.

In the example before me of this very fine insect the frontal horn rises to about the level of the top of the prothorax, and is quadrangular in shape at the base, a keel running from each of the front angles about a quarter of the distance up it, and from each of the hind angles about two-thirds the distance to its summit; the upper part is cylindric and tapering. The prothorax is strongly and roughly punctured on the sides, this sculpture being continued up the portion adjacent to the excavation, but the middle and basal parts are smooth, except in the deep basal furrow where, however, the puncturation is wanting in the middle; the excavation occupies the larger part of the whole surface, and is cavernous, with sharply defined limits especially on the sides; the horns (or teeth) are about half as long as the distance from the base of the prothorax to that of the excavation, are compressed, and triangular, their wide face being about as wide across the base as the lower (which is the longer) side of their outline; they are situated on either side of the excavation, about half-way down the declivous face of the prothorax and project forward, and slightly upward; the portion clothed with golden hairs is the inner surface of the overhanging margins.

The nearest ally of this species is, I think, *B. cavicolle*, MacL., from which it differs *inter alia* by the transverse carina in front of its frontal horn being evenly arched forward and not at all turned up in the middle, by the absence of a tooth on the hind surface of the frontal horn, by the very much larger excavation on its prothorax, by the presence of golden pubescence within the same, by the much more feebly punctulate striae of its elytra, and its very much more slender front tibiae, the inner margin of which is evenly and gently concave from the base to the apical spine.

Northern Territory of S. Australia; taken by Professor Tate.

B. GLOBULIFORME, MacL.

The description of this species does not indicate any satisfactory distinction from that of *B. rotundatum*, Hope. There are specimens before me evidently, I think, appertaining to the latter

species and taken by Mr. J. P. Tepper, at Port Darwin, which I cannot distinguish from a short series in the S. Australian Museum ticketed as having been taken at Rockhampton, Queensland (*B. globuliforme* was described on specimens from Port Denison, Queensland), and which agree very well with the description of either insect. If *B. globuliforme* is a good species it would seem desirable for it to be re-described and its distinction from *B. rotundatum* pointed out. A study of the descriptions of *B. rotundatum* and *rubescens* by both Hope and Westwood, together with the figures supplied by the latter, creates a doubt, moreover, of the distinctness of the two; the figure shows a difference in the shape of the prothorax that would appear satisfactory enough, but unfortunately it is not alluded to by either author in *stating* the differences between them.

B. SIMPLICICEPS, sp.nov.

Rotundatum, rufum, supra glabrum; clypeo in medio in tuberculum elevato, lineis 4 elevatis ex hoc tuberculo prodeuntibus, scil. 2 ad angulos clypei anticos, 2 (postice tuberculatim elevatis) ad basin antennarum, inter has lineas interveniis fortiter rugose punctulatis; capite postice æqualiter leviter convexo, sparsim minus fortiter punctulato; prothorace ad latera fortiter acervatim punctulato, fossulato, vix evidententer canaliculato (canali obsoleto punctis nonnullis indicato) antice breviter retuso, spatio retuso longitudinaliter 3-sulcato, inter sulcos interspatiis postice sub-tuberculatis; elytris leviter 9-striatis striis subtiliter punctulatis; tibiis anticis externe 5-dentatis. Long. 4 lines, lat 2 $\frac{2}{3}$ lines.

The nine striæ of the elytra do not include the one close to the lateral margin, which bends inward from the margin near its base like an oblique fovea; of the nine the nearest two to the suture are much stronger than the others. In the five specimens that I have seen there is very little difference likely to be sexual; in one of them the lateral two of the three longitudinal furrows on the retuse part of the prothorax are almost obsolete, and the puncturation of the head differs, the rather large punctures of the

front and back of the vertex not failing altogether in the intermediate part, whereas in other examples the middle of the disc (from about the level of the middle of the eye hindward almost to the base) is quite devoid of such punctures, having only a few exceedingly fine ones.

This species must be very like *B. planiceps*, MacL., (from Sweer's Island). If I understand the description of that species rightly, however, the thorax is differently sculptured in front; and in any case the front tibiae are very different, having five well-defined external teeth increasing in size from the topmost downward, without any trace whatever of a sixth, while *planiceps* is described as having six external teeth on the front tibiae, of which the basal two are subobsolete.

Northern Territory of South Australia; collected by Professor Tate.

B. FENESTRATUM, sp. nov.

Rotundatum; rufum vel piceum; supra glabrum; clypeo in medio vix in tuberculum elevato, lineis 4 ex hoc quasi tuberculo prodeuntibus, scil. 2 ad angulos clypei anticos, 2 ad basin antenarum; capite toto dense rugose crasse punctato, vertice medio carina transversa arcuata instructo; prothorace ad latera fortiter punctulato, fossulato, vix evidenter canaliculato (canali obsoleto punctis quibusdam magnis indicato); antice vix retuso, parte antica fovea magna subquadrata punctulata instructa; elytris usitate striatis, striis profundis leviter vel vix evidenter punctulatis; tibiis anticis externe 6 vel 7-dentatis, dentibus apicalibus 4 solis distinctis.

Long. 4 lines (vix), lat. $2\frac{2}{3}$ lines.

The fovea on the front declivous part of the prothorax is of peculiar form, being nearly square on the surface but ending almost in a point at the bottom as though a quadrangular pyramid had been cut out; in some specimens this is very sharply defined, in others less so, but in all that I have seen some (at least) of the declivities of the excavation are sharply triangular. In the specimen I have described the front tibiae have the apical

four teeth well defined though blunt, and above them the external edge is cut on one tibia into two, on the other into three, obsolete teeth; in several examples I find all the lower teeth decidedly sharper than in the type, and the upper not quite so feebly developed. If I have both sexes of this insect before me, the sexual distinctions are very slight, but in that case probably the specimen described is a female, as I have a much mutilated example in which the clypeal tubercle is better developed than usual, with the lines running from it to the bases of the antennæ evidently more elevated.

Northern Territory of South Australia; collected by Dr. Wood, also by Professor Tate.

MÆCHIDIUS CAVICEPS, sp. nov.

Oblongus; sat convexus; minus nitidus; rufo-piceus; setosus; capite prothoraceque fortiter crasse, elytris (seriatim, seriebus haud geminatis) subtilius, punctulatis; clypeo antice sat longe producto, utrinque fortiter concavo, antice triangulariter emarginato; unguibus haud simplicibus.

[Long. 4 lines, lat. 2 lines (vix).

The clypeus is considerably produced almost at a right angle with the rest of the head; its emargination is sharply triangular, the sides of the same being acutely pointed in front; the deep concavity on either side is extremely shining. The prothorax is nearly twice as wide as down the middle it is long; its sides (owing to the roughness of the surface sculpture) are strongly crenulate, strongly (almost angularly) rounded behind the middle and not at all sinuate; its hind angles are slightly obtuse, but very nearly right angles; the granules of the punctures on the surface fill them up and protrude above them, making the prothorax appear almost tuberculate. The elytra are a little dilated behind, where they are nearly a third as wide again as the prothorax; they are punctured in regular rows which have no tendency to run in pairs, the punctures in the rows being decidedly small as compared with those of the generality of species

of *Mæchidius*; the interstices are quite flat, impunctate, and rather nitid. The hind femora are not particularly stout, the basal joint of the hind tarsi is not much longer than the second, and the claws have the quill-like appendage frequent in species of this genus.

Seems to resemble *M. bilobiceps*, Fairm., and *Albertisi*, Fairm., but both those species are described as having the rows of punctures on the elytra running in pairs, the former having the thoracic sculpture obsolete at the sides, the latter the sides of the prothorax sinuate behind, besides other differences. From *M. rufus*, Hope (of which I have a specimen before me), the totally different structure of the hind legs, besides many other differences, will at once distinguish this insect.

Northern Territory of S. Australia; taken by Mr. J. P. Tepper.

LIPARETRUS PALMERSTONI, sp. nov.

Ovatus; sat nitidus; ferrugineus, capite postice et (nonnullis exemplis) tibiis, tarsis, abdomineque obscurioribus; longe sparsim hirsutus, sat sparsim punctulatus; tarsorum posticorum articulo primo secundo breviori; tibiis anticis externe haud dentatis; clypeo concavo producto,—maris antice late emarginato, angulis anticis subacutis,—feminae antice truncato, angulis anticis rotundato-obtusis; antennis 9-articulatis.

[Long. $2\frac{1}{3}$ lines, lat. $1\frac{1}{5}$ lines (vix).

This species belongs to Mr. Macleay's first section of the genus, and is much smaller than any other of that section previously described. The long sparing pubescence with which it is clothed seems to be entirely wanting on the elytra, which are very short, leaving a great deal of the propygidium exposed,—neither it nor the pygidium has any trace of a keel. The inner two pairs of striae on the elytra are tolerably distinct, their interstices however being punctured in a coarse rather sparing manner uniformly with the general surface. The hind tibiae and tarsi are nearly black in most examples. The anterior tibiae are much prolonged at the apex.

Northern Territory of S. Australia; collected by Mr. J. P. Tepper.

L. POSTICALIS, sp.nov.

Ovatus ; minus nitidus ; ferrugineus vel ferrugineo-piceus, capite nigricanti ; minus hirsutus ; capite confertim rugose, prothorace fortius vix crebre, elytris fortiter sat sparsim, pygidio haud evidenter, punctulatis ; elytris sat evidenter geminato-striatis ; clypeo antice rotundato ; tarsorum posticorum articulo primo secundo vix breviori ; tibiis anticis externe obtuse 3-dentatis ; antennis 9-articulatis.

Long. $3\frac{2}{3}$ lines, lat. 2 lines (vix).

The specimens before me may be slightly abraded ; their upper surface is glabrous excepting a fringe of longish stout hairs on the sides of the prothorax, but probably in fresh examples the pygidium and propygidium are thinly clothed with long hairs. The elytra have three very distinct pairs of punctate striæ, and a fourth much fainter, the punctures in the striæ being strong and rather close, but not different in character from those with which the interstices between the pairs are rather sparingly sprinkled. The puncturation of head, prothorax, and elytra is successively more and more sparing. The pygidium and propygidium are finely coriaceous and almost opaque ; under a strong lens indications of scarcely impressed and very sparing punctures may be traced, especially towards the apex of the latter ; there is no trace of a keel. The prothorax is scarcely channelled longitudinally. The elytra are about twice as long as the prothorax down its middle line. The underside is thinly clothed with long hairs. This species may be distinguished from *L. picipennis*, Germ., and *L. atriceps*, MacL.,—both of which it resembles in many respects,—by its opaque impunctate pygidium, and from the latter by its strongly punctate elytra. The specimens before me are probably females.

Northern Territory of S. Australia ; collected by Mr. J. P. Tepper.

N.B.—An example of *Liparetrus* before me from the same locality as the above, differs in having the elytra considerably shorter ; I hesitate to consider it a distinct species, as I can discover no other distinction ; possibly it is the other sex.

L. JUVENIS, sp.nov.

Ovatus; sat nitidus; ferrugineus; capite toto, mesosterno et metasterno (his parte media excepta), piceis; minus hirsutus; capite fortius, prothorace subtilius, elytris fortius, pygidio propygidioque leviter, sparsim punctulatis; elytris sat evidenter geminato-striatis; clypeo antice rotundato; tarsorum posticorum articulo primo secundo vix breviori; tibiis anticis externe fortiter 3-dentatis; antennis 9-articulatis. Long. $3\frac{1}{2}$ lines, lat. $1\frac{1}{3}$ lines.

Closely allied to *L. posticalis*. The prothorax is a little more transverse, being quite twice as wide as it is long down the middle, otherwise there seems to be no difference in respect of general form, proportions, or distribution of hairs. The head is quite smoothly and sparingly punctulate,—the prothorax and elytra are more finely punctulate than those of *L. posticalis*; the latter scarcely differ otherwise. The puncturation of the pygidium and propygidium (which have no trace of a keel) is very distinct, though sparing and lightly impressed. The lower two teeth of the anterior tibiæ are very strong and sharp. The prothoracic channel is scarcely traceable.

Like *L. posticalis* this species belongs to the *picipennis* group of *Liparetrus*. The sparing puncturation of its head distinguishes it from most of the members of that group, its color and structure of the legs from nearly all the remainder. Judging by the very brief description of *L. latiusculus*, MacL., it probably resembles that insect, but is much larger, and apparently of a very different color, and no doubt differs in other respects.

Northern Territory of S. Australia; collected by Mr. J. P. Tepper.

L. FALLAX, sp.nov.

Ovatus; sat nitidus; minus hirsutus; ferrugineus, capite (nonnullis exemplis) piceo; hoc confertim rugose, prothorace fortius nec crebre, elytris crebrius sat fortiter, pygidio crebrius leviter, punctulatis; elytris sat evidenter geminato-striatis, clypeo antice

et ad latera truncato, tarsorum posticorum articulo primo secundo paullo breviori; tibiis anticis externe obtuse 3-dentatis; antennis 8-articulatis. Long. 4 lines, lat. 2 lines.

In this species the clypeus has the form (although not very sharply defined), which Mr. Macleay, in his monograph of the genus, calls "presenting three truncate faces." Its general resemblance to *L. posticalis* is considerable. The head is punctured almost exactly as in that species; the prothorax is more transverse, being quite twice as wide as it is long down the middle, and is slightly more sparingly and finely punctured. The elytra are a little longer in proportion, being more than twice as long as the prothorax, with slightly finer and closer puncturation, and the striae of each pair a little closer to each other. The tarsi are evidently more slender. No species hitherto described is very close to this.

Northern Territory of S. Australia; collected by Mr. J. P. Tepper.

LEPIDIOTA DARWINI, sp. nov.

Ferruginea, supra sat sparsim, subtus densissime, albo-squamulata; capite lato minus convexo, clypeo perbrevis antice in medio reflexo emarginato; prothorace fortiter convexo, sat transverso, antice angustato, lateribus post medium rotundato-ampliatist postice fortiter sinuatis, angulis posticis acutis; tibiis anticis tridentatis.

[Long. $10\frac{1}{2}$ -12 lines.

Mas (?) Angustus, elytris subparallelis.

Fem. (?) Latior, elytris postice ampliatis.

The sides of the clypeus, and the head backward to the level of the middle of the eyes, are coarsely and sparingly punctured, each puncture being filled up with a white scale (which, however, does not, or not much, protrude beyond it); the length of the clypeus down the middle line is much less than half the length of the coarsely punctured part behind it of the head; the clypeal suture is regularly and widely bisinuate; the part of the head behind the

coarsely punctured portion is smooth except that there are some very fine (in the examples before me scaleless) punctures in the middle. The prothorax at its widest part is slightly more than half again as wide as it is long down the middle; its base (which is bisinuate) is about half again as wide as its front margin (which is decidedly though gently emarginate); its front angles are obtuse, but well defined, those at the base pointed and a little directed outward; its lateral margins are slightly crenulate and diverge in nearly straight lines to behind the middle where they are strongly and suddenly rounded, thence proceeding with a rather strong sinuation to the base; its surface is punctured and scaled uniformly with the coarsely punctured part of the head, although a little more closely towards all the margins than on the disc; there is a broad thickened margin all across the front, which is punctured and scaled uniformly with the neighbouring surface. The elytra and scutellum are punctured and scaled very similarly to the prothorax, and the former bear obscure indications of three or four wide scarcely convex costæ. The propygidium, pygidium and the entire undersurface are densely covered with closely packed white scales which entirely conceal the derm, and the sternæ are clothed rather thickly with long white hairs. The legs are coarsely and sparingly punctured and scaled; the front tibiæ are tri-dentate externally, the upper tooth very small.

The above description is founded on the only really fresh specimen before me,—which I take to be a female. Its elytra are considerably dilated backward to near the apex and the apical ventral segment is more than half the length of the penultimate with its apical margin evenly rotundate-truncate. In what I take to be the male the head and prothorax are of a pitchy color (probably merely an individual variety), the surface of the prothorax is obscurely uneven through the presence of some irregular ill-defined scarcely convex ridges. the elytra are extremely parallel, the apical ventral segment is much less than half the length of the penultimate with its apical margin widely and feebly bisinuate, and the whole insect is much narrower than the other sex. The antennæ of these two specimens do not differ noticeably in structure.

Northern Territory of S. Australia ; collected by Prof. Tate and Mr. J. P. Tepper.

L. DELICATULA, sp.nov.

♀. (?) Ferruginea, supra confertim subtiliter, subtus densissime, albo-squamulata ; capite minus lato minus convexo ; clypeo minus brevi, antice in medio sat fortiter reflexo-emarginato, ad latera fortiter rotundato ; prothorace sat convexo, sat transverso, antice angustato, lateribus post medium ampliato-rotundatis postice haud sinuatis, angulis posticis obtusis ; tibiis anticis fortiter tridentatis ; elytris postice fortiter ampliatis. Long. 16 lines.

Sexus alter latet.

The clypeus and head (backward to the level of the middle of the eyes) are uniformly sparingly and rather strongly punctured and scaled ; the length of the clypeus down its middle line is not much less than that of the coarsely punctured part behind it of the head, the sides of the same being quite strongly rounded ; the clypeal suture is unevenly bisinuate, the middle part of the sinuation (with its convex side running up the head) being very much more strongly curved than the lateral (anteriorly convex) parts of the sinuation ; the part of the head behind the strongly punctured portion is finely and densely clothed with scales. The proportions of the prothorax scarcely differ from those of *L. Darwini*, except that the segment is slightly more transverse ; the lateral margins are slightly crenulate, and behind the post-medial curve (which is almost angular) are very nearly straight, and the hinder angles quite obtuse ; the surface is rather closely (especially towards the sides), but not coarsely, punctured and scaled ; there is a smooth dorsal line in the hinder half ; the front is very finely margined, the margin punctureless. The elytra and scutellum are punctured and scaled even more finely and closely than the prothorax, the former being wrinkled transversely, but not coarsely, and scarcely costate. The propygidium, pygidium, undersurface and legs scarcely differ from those of *L. Darwini*, except in the upper external tooth on the front tibiæ being stronger, and the

apical tooth more strongly curved outwards. The apical ventral segment is more than half as long as the penultimate; a shallow channel runs down its middle and its hind margin is slightly emarginate in the middle.

Northern Territory of S. Australia; collected by Prof. Tate.

L. *ROTHEI*, Blackb.

This species was described by me in the "Transactions of the Royal Society of South Australia," of last year, but I was unable to state from what locality it had emanated. There have lately been referred to me for determination about half-a-dozen specimens of it taken in the Northern Territory, and no doubt the original type came from the same quarter. Comparing it with the two species described above, I find that the clypeus is somewhat intermediate, being less rounded at the sides and more transverse than in *L. delicatula*, but more rounded laterally and less transverse than in *L. Darwini*; the prothorax a little more transverse than in either and less rounded anteriorly, at its widest very little behind the middle; the elytra much more evidently costate, the puncturation throughout closer and the scales less conspicuous, &c., &c. I cannot find any sexual distinction among the specimens I have seen of *L. Rothei*, and believe them all to be females; and was probably mistaken in my conjecture that the original is a male. In all, the apical ventral segment is a little more than half as long as the penultimate, its surface glabrous and almost impunctate, and its hind margin gently and evenly arched.

[The length varies from $7\frac{1}{2}$ to 9 lines.

L. *DEGENER*, sp.nov.

Fusco-ferruginea; subrugose confertim punctulata; supra sparsim squamoso-hirsuta; subtus densius distinctius squamosa; capite minus lato minus convexo; clypeo sat brevi, antice in medio fortiter reflexo-emarginato, ad latera rotundato; prothorace sat convexo; sat transverso, antice minus angustato, lateribus mox post medium ampliato-rotundatis, postice haud sinuatis, angulis posticis rectis; tibiis anticis acute tridentatis. Long. $6\frac{1}{2}$ lines.

The puncturation is on the whole rather uniform over the entire upper surface, but becomes gradually a little finer and less close from the clypeus hindward to the apex of the elytra; the scales are small, elongate, and hair-like, and are rather closely distributed, but not very conspicuous. The clypeus is very strongly emarginate in front, the length from the base of the emargination to the clypeal suture being scarcely half the greatest length of the clypeus. The prothorax is about half again as wide as it is long down the middle, its base being less than half again as wide as its front margin. The elytra are scarcely costate, the indications of costæ appearing as mere irregularities of the surface which do not disturb the sculpture (in *L. Darwini* and *Rothei* the costæ are devoid, or very nearly so, of puncturation). On the underside the sculpture is of the same character as on the upper, but the puncturation is less rugose and more sparing, and the scales less hair-like. The teeth on the external edge of the front tibiæ resemble the same in *L. Rothei*, all being very sharp, the upper one much smaller than the lower two. The two specimens before me present no notable character likely to be sexual unless it be that the elytra of one are somewhat dilated behind the middle, while those of the other are narrower and more parallel.

The small size of this species will distinguish it from the three species previously described; the very small hair-like scales of its upper surface and almost non-costate elytra also are distinctive.

Northern Territory of S. Australia; taken by Mr. J. P. Tepper.

L. RUFA, sp. nov.

Rufa; supra capillis brevibus sparsim, subtus squamis parvis confertim, instructa; clypeo minus brevi, rugose crasse punctulato, antice in medio leviter reflexo-emarginato, ad latera rotundato; prothorace fortiter subrugose nec crebre punctulato, sat convexo, sat transverso; antice angustato, lateribus post medium ampliato-rotundatis, postice haud sinuatis, angulis posticis rectis; elytris sat crebre minus fortiter punctulatis; tibiis anticis obtuse tridentatis.

Long. $6\frac{1}{2}$ lines.

This species is closely allied to *L. degener*, from which it differs as follows: the clypeus is very much less strongly emarginate in front (resembling that of *L. delicatula*, but with the sides much less rounded), the prothorax is more narrowed anteriorly and much more sparingly punctured on the disc, the elytra are much more sparingly and less confusedly punctured, the scales on the upper surface are altogether hair-like, and the teeth on the outer margin of the front tibiæ are considerably blunter.

The three specimens before me appear to be of the same sex. The club of the antennæ is evidently longer than in the specimens of *L. degener* mentioned above (being nearly as long as the preceding six joints together), the elytra are dilated behind the middle, and the apical ventral segment is more than half as long as the penultimate (as in all the specimens of the genus that I have seen, except the one of *L. Darwini* mentioned above).

Northern Territory of S. Australia; taken by Mr. J. P. Tepper.

N.B.—It should be noted that in perfectly fresh examples the surface of some of the above species may very possibly be more densely scaled than I have described it, as the scales are very easily rubbed off; and it is probable that few cabinet specimens are quite as scaly as they were when freshly matured from the pupa.

Unless all the examples (with one exception) examined by me of the preceding species be of the same sex, the sexual distinctions are extremely slight.

PALMERSTONIA, gen.nov. (PIMELOPIDÆ).

Mentum in medio laminam compressam erectam conformans.

Mandibula prominentia, librata, extus obtuse bidentata.

Maxillæ haud observatæ.

Palpi maxillares validi, articulo 1° parvo, 2° subcylindrico, 3° parvo, 4° subconico antennarum clavâ paullo breviori.

Palpi labiales toti aperti, articulo 1° subcylindrico, 2° parvo, 3° subgloboso antennarum clavâ vix minore.

Antennæ 10-articulatæ, clava 3-articulata, sat parva.

Labrum breve transversum.

Clypeus ad perpendiculum directus.

Oculi magni.

Prothorax (? unius sexus solum) antice vix impressus.

Scutellum sat magnum transversum.

Tibiæ anticæ (? unius sexus solum) externe fortiter 3-dentatæ intus apice spinas singulas ferentes ; posteriores 4 unicarinatæ, apice spinas binas latas ferentes.

Tarsi antici perlongi, posteriores 4 breves, posticorum articulo primo valde dilatato.

Processus prosternalis post coxas erectus spiniformis.

Stridulationis organa nulla (?).

This is one of the most extraordinary insects I have ever seen. Its general appearance is that of a female *Pimelopus*, but some of its characters are quite anomalous, especially that of its exposed labial palpi, which are inserted on either side the vertical lamina of the mentum, and bear (as their apical joint) a large round ball flattened on one side. The clypeus is bidentate in front, very strongly angulated at the sides and thence narrowed to the base, which is roundly emarginate; it is almost perfectly vertical, its plane being at right angles to the surface of the hinder part of the head, and its base rising considerably above the surface, so that viewed from the side the head seems to rise into a bilobed keel, and to be abruptly truncate in front,—while viewed from in front the clypeus looks like an erect shield. The mentum no doubt resembles that of *Nephrodopus*. The basal joint of the antennæ is not much shorter than the following six together; the 2nd is considerably longer than any of the next five, which are all short; the club is about as long as the 2nd joint of the anterior tarsi. The inner apical spine of the front tibiæ is a little longer than the basal joint of the tarsus. On the posterior 4 tibiæ there are traces of a transverse keel near the base in addition to the well-defined one below the middle. The front tarsi are very much longer than,

the middle equal to, the posterior shorter than, their respective tibiæ. The hind legs scarcely differ from those of *Pimelopus*, except in not having two distinct carinæ on the tibiæ and having slightly longer tarsi with the 2nd joint not dilated. The prosternum in front of the anterior coxæ consists of an elongate shining triangular plate, the wide end of which is directed forward, the narrow end entering between the coxæ. The propygidium is squamosely punctulate at the sides, delicately transversely wrinkled in the middle; this transverse wrinkling may perhaps be feeble means of stridulation. The pygidium bears a system of very faint but not very fine puncturation which is more obsolete in the middle than at the sides.

P. BOVILLI, sp.nov.

Nitidus; valde convexus, latitudine majori pone medium posita; totus rufo-castaneus; supra (clypeo labroque exceptis) glaber; clypeo sparsim, prothorace vix evidenter, elytris sparsim obsolete crasse, punctulatis; his oblique obsolete 4-costatis, striâ suturali fortiter impressâ; subtus longe nec dense pubescens.

[Long. 12 lines, lat. 7 lines.

The entire insect is of a chestnut red color, a little paler on the underside. The labrum is clothed rather thickly with long hairs. The clypeus is nearly twice as wide as long, and is sparingly beset with small sharply defined punctures, each of which bears a long hair. The head behind the clypeus is very short. The prothorax is about a third as wide again as long, its anterior margin gently concave and about half the width of the base, the sides viewed from above seeming to diverge very strongly from the small acute anterior angles, and then run round with a very feeble curve to the base, which is rather strongly bisinuate, the hind angles being scarcely defined, but when viewed from the side the lateral margins are seen in reality to form an even and strong curve; there is a scarcely traceable impression at the middle of the disc near the front margin, and in my specimen a series (very probably abnormal) of

four round smooth foveæ placed transversely across the disc a little in front of the middle. The scutellum is impunctate. The elytral costæ are all very faint, the external one scarcely discernible (in my example it is quite lost on one elytron, nearly so on the other). On the underside the following parts are clothed with long but not close pubescence,—the mentum, the front of the prosternum, the reflexed margins of the pronotum, the prosternal process, the lateral portions of the meso- and meta-sterna, and a line across each ventral segment. All the above pubescence is erect except that at the front of the prosternum, which is directed forward, but with a tuft in the middle erect. The legs, the basal two joints of the antennæ, and also the ocular canthus are clothed with long hairs.

A single specimen (apparently a female) was sent to me from Palmerston, N. Territory, by Dr. Bovill.

CACOCHROA OBSCURA, sp.nov.

Minus convexa; nigra; supra glabra; pygidio, corpore subtus, et pedibus plus minus ferrugineo-hirsutis; clypeo sat fortiter punctulato, antice sat fortiter emarginato; prothorace sparsim obscure (lateribus sat fortiter) punctulato, angulis posticis rotundatis; elytrorum disco fortius sublineatim punctulato, lateribus crasse transversim rugatis; tibiis anticis 3-dentatis.

[Long. 8 lines, lat. 4 lines.

The head closely resembles that of *Cacochroa gymnopleura*, but is more closely punctured in the hinder part. The prothorax is gently lobed in the middle behind, and is not much less than twice as wide at the base as it is long down the middle, its front margin being less than half as wide as its base; its hind angles are quite rounded off; its surface is very sparingly and finely punctulate, except near the front margin (where the puncturation is rather stronger and closer) and near the sides (where it is very strong and coarse); the lateral furrow (within the thickened margin) does not reach the base, but ceases where the side begins to round off to the hind margin. The scutellum is elongate, with

the apex sub-bifid owing to the presence of a longitudinal channel which commences obsoletely close to the base, and gradually deepens to the apex. The disc of the elytra is punctured uniformly with that of the prothorax, and also bears some much coarser puncturation, which has a tendency to run in rows, these rows seeming here and there to be placed in feeble striæ; the lateral portions of the elytra and also the apex are devoid of puncturation, but are sculptured with a well-developed system of coarse transverse wrinkles, commencing behind the post-humeral contraction; the apices are separately rounded; the suture is convex near the apex, but not at all produced behind. The pygidium is sparingly strigose and sparingly furnished with rather short hairs. The sternal portion of the undersurface is strongly and sparingly punctured (the flanks of the pro- and mesosterna being strigose), the metasternum most strongly; of the ventral segments the first is transversely strigose on either side at the base, the rest are almost devoid of sculpture except that segments 2-5 are longitudinally concave in the middle (probably in one sex only) the concavity being punctulate and hirsute, that segments 4 and 5 have a transverse ciliated line of punctures on either side, and that segments 1-4 bear on either side a closely and finely punctured opaque space (very likely tomentose in a fresh specimen), which is subquadrate on segment 1 and triangular on the rest; there is similar sculpture on either side of the pygidium; the sterna are sparingly and shortly hirsute. The front coxæ and femora and the four posterior femora and tibiæ have their undersurface densely clothed with long pale hairs (? in both sexes), and the front tibiæ (perhaps in the female only) are tridentate, the upper tooth very much smaller than the others. The antennal club in the specimen before me (probably a female) is a little shorter than the length, in front of the eye, of the clypeus. The mesosternal process protrudes forward beyond the front of the intermediate coxæ nearly as far as the length of the basal 3 joints of the front tarsi, and is thick and somewhat cylindric at its base; in shape it resembles the same part in *Polystigma punctata*, Don., but is longer and stouter.

The post-humeral contraction of the elytra is quite as in *Cacochroa*, and allows quite as much (as in that genus) of the metasternum and hind coxæ to be seen from above. The mesothoracic epimera also are conspicuously visible from above.

This species does not appear to me to fall exactly into any of the numerous genera of Australian *Cetonia*, but, as it has very much the appearance of a *Cacochroa*, I have preferred to refer it to that genus, and describe its structural characters fully, rather than create a new genus. It differs from *Cacochroa* chiefly in having the base of the prothorax a little inclined to be lobiform in the middle (not so much as in *Polystigma*), and the hinder angles of the same rounded off, while the former of those characters, together with its deeply emarginate clypeus, &c., &c., separate it from *Aphanesthes*. The extremely strong post-humeral contraction of the elytra will distinguish it from most of the other genera which possess a long mesosternal process.

Northern Territory of S. Australia ; taken by Mr. J. P. Tepper.

BUPRESTIDÆ.

NEOSPADES LATERALIS, sp. nov.

Sat convexus ; capite prothoraceque læte viridibus, vix aureo-unicantibus ; elytris obscure cupreo-æneis, albo-maculatis, antice lateribus læte viridibus ; subtus æneus vel viridis, abdominis lateribus albo-maculatis ; capite confertim fortiter rugose punctulato ; prothorace transversim strigoso ; elytris fortius vix crebre punctulatis, apicem versus subtiliter serratis ; corpore subtus sparsim griseo-pubescenti, subtilius squamose (prosterno crasse fortius) punctulato ; tibiis posticis apicem versus tribus capillorum penicillis instructis.

Long. $4\frac{1}{2}$ lines, lat. $1\frac{3}{4}$ lines.

The elytra are of a dull coppery æneous color. The spots of white pubescence are on each elytron—two on the hinder part of the lateral margin, and three or four near the suture in the hinder two-thirds ; the green patch commences on the base and extends slightly more than half way to the apex, occupying the external

half of the surface but being interrupted by the humeral callus (which is of a golden copper color) and a little contracted at its apex externally; it is bordered except at the base and the front part of its lateral edge by golden copper color. The pattern and colors of the upper surface do not appear to be variable. The underside is for the most part of a dull olivaceous tint, and is more or less closely covered with small scale-like pubescence; in some examples the underside (especially the metasternum) is in parts of a decided green. The head is somewhat convex and is longitudinally impressed between the eyes. The prothorax is less than half again as wide as it is long down the middle, its base, which is bisinuate, being about a third as wide again as its front margin, which also is bisinuate; the true margin is very slightly arched and is strongly bent under the head and front. The three little elevations (each bearing a pencil of pubescence) near the apex of the external margin of the hind tibiæ are a conspicuous character.

Very different from *N. chrysopygius*, Germ., in the markings of its elytra and other characters. *Cisseis cuprifera*, Gestro, is probably a member of this genus, and must be very close to Germar's species.

Northern Territory of South Australia; collected by Mr. J. P. Tepper.

N. SIMPLEX, sp. nov.

Sat convexus; nitidus; viridis, aureo-micans; elytris opacis, obscure cupreo-æneis, his et abdominis lateribus albo-maculatis; capite sat confertim subrugose punctulato; prothorace subtiliter transversim rugato evidenter punctulato; elytris transversim strigosis, obscure punctulatis, apicem versus obsolete serratis; corpore subtus sparsissime breviter griseo-pubescenti, subtilius squamose (prosterno crasse fortius) punctulato; tibiis posticis postice nigro-ciliatis. Long. $3\frac{1}{2}$ lines, lat. $1\frac{1}{2}$ lines.

The spots of white pubescence on the elytra and hind body are arranged as in the preceding species. The color of the elytra is

very confused appearing different in different lights ; it is a dull coppery purple, much brighter at the apex than in front, but in some lights the middle of the disc near the front and an ill-defined fascia just behind the middle appear blue ; in some specimens the ground color appears to be brighter (especially towards the sides) than in others. The head is very decidedly more convex than that of *N. lateralis*, with the longitudinal furrow deeper and the puncturation not quite so close or rugose. The prothorax scarcely differs from that of *N. lateralis* (apart from its color, which is a much more *golden green*), except in having somewhat more distinct puncturation in addition to its strigosity. The transverse wrinkling of the elytra is scarcely existent behind the middle ; the puncturation is very obscure being rather sparing, coarse and shallow, the punctures in some specimens appearing to be filled up, and in some specimens the filling seems to protrude as though the elytra were obscurely granulose rather than punctured. The hind tibiæ are lightly keeled externally in their apical two-thirds, the keel bearing a fringe of close-set erect fine black hairs.

Northern Territory of South Australia ; collected by Mr. J. P. Tepper.

CISSEIS ELONGATULA, sp. nov.

Angusta ; supra obscure cupreo-nigra, capite roseo-cupreo ; subtus ænea sat nitida, elytris et prothoracis lateribus albo-maculatis ; capite subplano, subopaco, longitudinaliter leviter sulcato, sat fortiter nec crebre nec rugose punctulato ; prothorace transversim subtiliter strigoso ; elytris squamose sat crasse punctulatis, antice et latera versus transversim rugatis, apicem versus serratis ; corpore subtus obscure (prosterno crassius) squamose punctulato.

[Long. $2\frac{1}{2}$ lines, lat. $\frac{1}{3}$ line.

The head is nearly flat with a distinct dorsal furrow, and is opaque of a bright rosy color, and its puncturation is rather large and moderately close, very clearly defined, but not deep or rugose, the punctures very little confused by transverse wrinkles ; the head is very like that of *C. roseo-cuprea*, Hope, but more strongly punctured. The prothorax is a little more than a third as wide

again as long ; the base and front margin are both bisinuate, the former about a quarter as wide again as the latter ; the sides nearly straight, the surface very delicately wrinkled transversely with a fairly well-marked longitudinal impression on either side at the base. The puncturation of the elytra is very vague, and scale-like in appearance, the transverse wrinkles are fairly well-defined in front and at the sides. The spots of white pubescence on the elytra resemble those of the preceding two species. The almost flat, opaque, finely coriaceous head with distinct, not very close-set punctures, and scarcely any trace of wrinkles, together with very small size, narrow parallel form, and obscure color will distinguish this from all other species yet described of *Cisseis*. In my opinion it, *roseo-cuprea* and some other species might well form a new genus differing from *Cisseis* in their short strongly compressed tarsi, which approach those of *Neospades*, though the claws and antennæ resemble *Cisseis*. These insects seem to occupy a doubtful position between *Agrilidæ* and *Trachydæ*.

Northern Territory of S. Australia ; taken by Mr. J. P. Tepper.

TENEBRIONIDÆ.

HELEUS.

Through the courtesy of the Hon. W. Macleay in examining a series of *Helæus* from my collection and comparing them with his types, as well as in furnishing me with types of several species that were not represented in my collection, I am able to offer some notes on this genus, together with descriptions of several new species, and to do so with some confidence that I mean by the various specific names the same insects that are referred to under those names in No. V. of the "Miscellanea Entomologica." I do not consider it a certainty that in every case Mr. Macleay applies the names to the same insects that were before the original describers,—nor does Mr. Macleay himself consider it so ; but as there are so many of these of which the positive identification is (either absolutely, or) at least to Australian students, *impossible*, I

think Mr. Macleay has acted on the right principle (in dealing with those descriptions which might apply to anyone of several species) in selecting a particular one to bear the name and describing it so fully,—expanding the original description,—that it may be at least clear to what insect *he* applies the name,—thus leaving to any student who may possess information that has not come before Mr. Macleay the burden of correcting him if he is wrong. There are so many Australian species the types of which Europeans have described badly and then lost, that Australian students must choose between the course Mr. Macleay has adopted and that of holding aloof from describing the insects of their own country.

In dealing with the species before me of this genus I propose, then, to accept the whole of Mr. Macleay's determinations as conventionally correct, although in some instances I may express a doubt of their absolute correctness, so that my remarks will be in harmony with his valuable monograph of the genus, and consequently whatever corrections may eventually be applied to his determinations will have to be read into my remarks.

H. PRINCEPS.

I expect to find eventually, as Mr. Macleay evidently thinks probable, that the South Australian species to which he applies this name is distinct from the Western Australian species on which Hope's vague description is founded.

H. INTERMEDIUS, de Brême.

I regard this as the most doubtful of all Mr. Macleay's determinations, as I fail to find in the insect to which he applies this name any more distinct abbreviated elytral costa than there is in all its allies. In my opinion the following species (which Mr. Macleay considers hitherto undescribed) is quite as likely to be the true *H. intermedius* as that to which Mr. Macleay has appropriated the name, but, in accordance with the principle I have laid down, I accept his decision.

H. BREVICOSTATUS, sp. nov.

Sat latus ; ovatus ; minus nitidus ; piceus, marginibus dilutionibus ; prothoracis marginibus subtilissime nec crebre granuloso, disco cornu valido erecto instructo ; elytrorum disco confuse crebre sat fortiter punctulato, sutura fortiter costata et utrinque costa abbreviata minus fortiter elevata instructa ; marginibus subtilissime sat crebre granulatis. Long. 14 lines, lat. $8\frac{1}{2}$ lines.

This species resembles that which Mr. Macleay in his monograph describes as probably identical with *H. princeps*, Hope ; compared with it the present insect is less dilated about and behind the middle of the elytra (the hinder part of the margin being very much narrower) ; the anterior prolongations of the prothorax are pointed and very much narrower, the turned-up edges of the same being thicker, less elevated and less erect ; the disc of the elytra is devoid of granules (except the marginal row) and the margins of the elytra are furnished only with excessively fine granules scarcely larger than those on the margins of the prothorax. *H. brevicostatus* is distinguished from all its allies by the abbreviated costa commencing at the base of each elytron just outside the scutellum and running obliquely towards the suture ; this costa is about $1\frac{1}{2}$ lines long and, though decidedly less elevated than the suture, is perfectly well-defined.

The prothorax is twice as wide as its length (from the base to the apex of the anterior prolongations), the disc occupying more than a third of its total width, and being uneven and finely punctured ; the "intermediate expansion" (as I will call the space between the disc and the turned-up edge that forms the true margin) is rather closely, evenly, and very finely granulate ; the true external margin is very thick, and narrow but not vertical ; the prothoracic horn is rather short, very stout, and scarcely directed backward at the apex. The intermediate expansion of the elytra is as wide at its base as that of the prothorax, but contracts rapidly to little more than half that width, and thence continues of somewhat even width to the apex ;

it is much turned-up, and its sculpture does not differ much from that of the same part of the prothorax ; the true margin of the elytra is much wider than that of the prothorax, and is most erect at about a third of its length from the base.

A single specimen ; the locality of its capture is uncertain.

H. HORRIDUS, sp.nov.

Oblongo-ovalis ; convexus ; nitidus ; ater ; prothorace subtilissime punctulato minute granulato ; elytris sat fortiter lineatim punctulatis, fortiter 7-seriatim tuberculatis.

[Long. 7 lines, lat. 4 lines.

The prothorax is at its widest at the base, whence its sides are contracted in a very gentle curve to the front ; the anterior projections are quite slender and slightly crossed ; the distance from the base to the front margin is decidedly less than half again as great as that from the front margin to the apex of the anterior projections ; the intermediate expansions are moderately wide, and are granulated not very finely, with some appearance of transverse wrinkling ; the margins are extremely thick and erect ; the disc is very finely and evenly punctured and also finely granulated, but there is a space almost free from granules on either side of the central line which is rather strongly keeled, the keel being strongest at the base ; the width of the prothorax is scarcely half again as great as its length. The elytra are densely punctured in 13 rows, which, however, are rendered scarcely traceable by the extent to which they are interrupted by the rows of large round tubercles that occupy the alternate interstices ; the 1st of these rows commences outside the scutellum as a strong interrupted costa which runs obliquely to the suture, and then margins it as a series of large tubercles nearly to the apex ; the 3rd row of tubercles also commences as an interrupted costa ; the tubercles of the 3rd and 5th rows are rather larger than the others and attain the apex ; in the 5th row there are about 10 tubercles ; the intermediate expansion is moderately wide at the base, but soon becomes narrower, and continues so to the apex,

its surface being quite smooth except close to the base, where there are a few tubercles; the margin is thick and well-defined: the epipleuræ of the elytra are very coarsely and strongly punctured. The underside is minutely granulate. The hind tibiæ are rather strongly flexuous (perhaps a sexual character); the prosternum is not at all carinate.

An extremely distinct species belonging to the same section of the genus as *H. echinatus*, Hope. Compared with that insect the following (among others) differences may be noted: general form very much narrower and more elongate; anterior processes of the prothorax much more projected forward making the segment longer; intermediate expansion of both prothorax and elytra decidedly narrower, but at the same time more sharply defined; the tubercles in the rows on the elytra in general much larger, especially those in the 1st, 2nd, 4th, 6th, and 7th rows, which, however, are very much smaller than those in the 3rd and 5th.

The South Australian Museum possesses a single specimen, probably taken in South Australia.

SARAGUS INÆQUALIS, sp. nov.

Ovalis; minus opacus; ferrugineus, capite prothoracisque disco infuscatis; hoc minute granulato, marginibus reflexis; elytris valde rugosis, antice tricostatis, interstitiis in parte postica tuberculatis, tibiis anticis calcare apicali gracili acuminato.

[Long. 7 lines, lat. $4\frac{2}{3}$ lines.

This species is so closely allied to *S. lævicollis*, Fab., that it will be sufficient to add to the above diagnosis an enumeration of its differences from that insect. Its ferruginous color, with only the head and the disc of the pronotum and prosternum darker may not be constant. Its shape is quite distinctive, the elytra being considerably longer in proportion to their width than those of *lævicollis*, and being uniformly, though very gradually, narrowed from the base to their apical half, which is rapidly contracted, the apical part being more pointed than in *lævicollis*. The front part

of the intermediate expansion of the prothorax is distinctly concave owing to its being turned up at the edge. The general surface of the elytra is much more coarsely rugose than in *lævicollis*, the costæ and tubercles being very similar when closely examined, but appearing at the first glance less conspicuous owing to the greater rugosities among which they are placed. The anterior tibiæ are narrower, the apical spur being long, very much more slender, and acutely pointed.

I have a single specimen taken by Mr. J. J. East near Mallala.

S. LINDI, sp. nov.

Late ovatus; opacus; niger; capite prothoraceque confertim subtiliter granulatis; hoc quam longiori multo plus duplo latiori, sat late marginato, marginibus planatis; elytris minute sparsius granulatis, fortiter tricotatis, interstitiis seriatim tuberculatis; tibiis anticis calcare robusto breviori instructis.

[Long. 6 lines, lat. $4\frac{1}{2}$ lines.

Another ally of *S. lævicollis*, F., but very distinct from it. The prothorax at its widest is twice and a-half as wide as down the middle it is long, and its base is nearly twice and a-half as wide as its front, the margins being without transverse wrinkles, and the basal portion being declivous backward, and bearing a large well-marked central impression; in other respects the head and prothorax resemble those of *S. lævicollis*. The elytra are not longer than together wide; their general surface, underlying the granules tubercles and costæ is quite smooth; this surface is sprinkled with minute granules which are sparing about the region of the scutellum but become closer towards the margin and apex; the suture is scarcely elevated near the base but becomes strongly so on the hinder declivity, and is bordered on either side by a row of close-set large granules, or small tubercles, some of which are conical and some elongate; each elytron bears 6 rows of strong elevations which cease at the beginning of the hind declivity; the 2nd and 4th of these form undulated nearly uninterrupted costæ; the others consist of elongate ridges resembling disconnected portions

of costæ ; as they are not symmetrical on the two elytra of my specimen the degree in which they are interrupted is no doubt very variable ; the elytra have rather strongly rounded sides and are widest in the middle ; the intermediate expansion is considerably wider than in *S. lævicollis*, and is but little narrowed near the apex. The underside resembles that of *S. lævicollis*. The legs and antennæ are a little reddish. The apical spur of the anterior tibiæ is short and blunt.

A single specimen occurred to me at Port Lincoln.

S. LATUS, sp.nov.

Sat nitidus ; subhemisphæricus ; piceo-brunneus ; capite prothoraceque confertim subtiliter granulatis ; hoc quam longiori multo plus duplo latiori, sat late marginato, margine antico concavo ; elytris minute granulatis, tricostatis (costis plus minus interruptis), interstitiis internis obscure seriatim tuberculatis ; tibiis anticis calcare gracili acuminato instructis.

[Long. 6 lines, lat. $4\frac{1}{2}$ lines (vix).

The head and prothorax are closely and minutely granulated, many of the granules on the latter, especially about the middle, being much elongated so as to give an appearance of longitudinal wrinkling. The prothorax is quite twice and a half as wide as it is long down the middle, and its base is twice and a half as wide as its front margin ; the intermediate expansion has no transverse folds, its anterior part is distinctly concave, and its granulation is quite continuous with that of the disc. The elytra are not at all narrowed at the base (which gives the insect a very distinctive subhemisphæric appearance) ; they are not at all longer than together wide ; the lateral half of their anterior margin is very obliquely cut away so as to meet the lateral margin in a very obtuse angle ; the intermediate expansion is very wide in front (considerably more so than in *S. lævicollis*), and is narrowed uniformly to the apex, where it is not wider than the same at the apex of the elytra of *S. lævicollis*, its surface being marked with transverse folds, and also with tubercles similar to those of the

disc (in some specimens the tuberculation is very obsolete); the disc is furnished tolerably evenly with rather close-set granules or small tubercles; the suture is scarcely elevated in any part; the three ridges usual in this section of *Saragus* are represented, the 1st by a strong straight (not undulating as it is in *S. lævicollis*) costa not reaching the apex; and having its apical half (or more) broken into tubercles,—the 2nd by a similar costa, which, however, is in most examples broken into tubercles from just behind its base,—the 3rd by a row of tubercles; each of the intervals between the suture and the 1st costa, between the 1st and 2nd and between the 2nd and 3rd costæ is occupied by a row of tubercles somewhat larger than those that form the general granulation of the surface, but there is no serial tuberculation whatever outside the 3rd costa. The spur of the anterior tibiæ is very much more slender and pointed than that of *S. lævicollis*. This species is not very close to any other *Saragus* known to me. Its subhemispheric form and shining surface will distinguish it from most of the species with the anterior tibiæ strongly spurred.

Murray Bridge; taken by Mr. Tepper.

S. MEDIOCRIS, sp. nov.

Subopacus; late ovatus; brunneo-niger; capite prothoraceque confertim subtiliter granulatis; hoc quam longiori plus duplo latiori, minus late marginato, margine antico vix concavo; elytris minute granulatis, tricostatis (costis undulatis plus minus interruptis), interstitiis seriatim tuberculatis; tibiis anticis calcare breviori obtuso minus gracili instructis.

[Long. $5\frac{1}{2}$ lines, lat. $3\frac{3}{4}$ lines.

The head and prothorax scarcely differ from the same parts in *S. Lindi*, except in the intermediate expansion of the latter being a little narrower. The elytra also resemble those of the same species almost exactly in respect of their costæ and rows of tubercles; there is, however, no well-defined row of tubercles running down the sides of the suture; the surface of the disc is very much rougher (making the small granules much less conspicuous) than in *S. Lindi*; the elytra are very little narrowed at

the base; and their intermediate expansion is extremely narrow even at the base, being markedly narrower than in *S. laevicollis*, with margins scarcely marked at all.

A single specimen in my collection; I have no note of the exact locality beyond that it was taken in South Australia.

SARAGUS MACLEAYI, sp.nov.

Late ovalis; convexus; sat nitidus; piceo-niger, antennis palpis et (nonnullis exemplis) tarsis dilutioribus; capite prothoraceque duplo-punctulatis (subtiliter et minus subtiliter); elytris multo fortius lineatis, interstitiis sparsim subtilissime, punctulatis, his nonnullis obscure convexus.

[Long. 4.5 lines, lat. 2 $\frac{3}{4}$ lines.

The prothorax is considerably more than twice as wide as down the middle it is long, and its base (which is bisinuate) is more than twice as wide as its front margin (which is deeply emarginate); its front angles are obtuse, the hinder ones sharp; its intermediate expansion is on either side rather less than a quarter the width of the disc, is not horizontal but declivous (though not sufficiently so to continue the lateral declivity of the prothorax evenly), and is gently narrowed from the base to the apex; its true margin forms a well-defined shining edge; the disc (as also the head) is thinly furnished with extremely minute punctures and also with larger (but still fine) ones; there is a transverse impression close to the front which makes the middle of the anterior margin appear somewhat elevated; there are also a number of obscure impressions all across the base (the intermediate expansion is much more roughly sculptured); each elytron is furnished with about 17 rather irregular rows of moderately coarse punctures, the interstices between the rows (especially the 4th, 8th, and 12th) being obscurely convex; the intermediate expansion is wide at the base, then contracts rapidly, and then continues rather narrow, but almost even in width, to the apex. The apical spine of the anterior tibiæ is not particularly large.

This species must be allied to *S. brunnipes*, Brême, and must differ from it *inter alia* in having only a small spine at the apex of the anterior tibiæ; from *S. brunnipennis* it differs *inter alia* in having its thorax more strongly punctured, and the interstices of its elytra more or less convex. Mr. Macleay tells me that it is distinct from everything known to him.

Sleaford Bay, near Port Lincoln.

S. ASPERIPES, Pasc.

An insect which I have taken several times at Port Lincoln agrees with Mr. Macleay's type (the Hon. gentleman informs me) of this species, and corresponds very well with Mr. Pascoe's description, but it should be noted that it is exceptional for the intermediate expansion of the elytra not to be marked with transverse folds. *S. asperipes* has much the appearance of a *Phosphuga*.

S. SATELLES, sp.nov.

Late ovalis; sat convexus; minus nitidus; piceo-niger, marginibus dilutionibus; capite subrugulose sat fortiter, prothorace duplo (subtiliter et subtilissime), elytris vix seriatim minus fortiter nec crebre, punctulatis; his obsolete tricostatis.

[Long. $7\frac{3}{4}$ lines, lat. 5 lines (vix).

The head is rugosely, confusedly, and closely punctulate with very fine and rather coarse punctures intermingled. The prothorax is twice and a half as wide as it is long down the middle, its base a little more than twice as wide as its front margin; its intermediate expansion is on either side about a third the width of the disc, and is subhorizontal, nearly flat, and of somewhat even width throughout its length; its true margin is well-defined, thick, shining, and not erect; the lateral outline is well rounded, the greatest width of the segment being just in front of the base; its surface is punctured on a uniform system, the puncturation is stronger and rougher close to the lateral edges (except near the

posterior angles), and becoming gradually smoother and more sparing towards the middle of the disc, and consists of fine and very fine punctures intermingled, the coarsest part being decidedly less coarsely punctured than the head. The punctures on the elytra are feeble (not much larger than the largest of those on the head); on the front part of the disc they run in traceable rows, but are much confused towards the apex and margins; there is no striation on the elytra; there are three longitudinal spaces representing the 4th, 8th, and 12th interstices, which are faintly convex and quite devoid of puncturation; the intermediate expansion is separated from the disc by a row of much larger punctures, and is rather narrow at the base, but does not contract much hindward, being at the apex about half as wide as at the base; at the middle of its length it is about as wide as the interval on the front part of the disc of the elytra between two of the rows of punctures.

This species belongs to the *Phosphuga*-like group of *Saragus*; compared with *S. asperipes*, Pasc., it is much larger, with the elytra not at all striate and much more finely punctured, the intervals between the rows (where they are traceable) of punctures being very much wider, the humeral angles quite rounded off, and the hind tibiæ devoid of distinct hispid asperities. Mr. Macleay has done me the favour of comparing the species with the types of *Saragus* in his collection, and does not find it identical with any of them.

Port Lincoln.

SARAGODINUS TUBERCULATUS, sp. nov.

Ovalis; opacus; ater; antennis pedibusque plus minus picescentibus; capite prothoraceque confertim subtiliter, elytris sparsim seriatim, tuberculatis; tibiis anticis externe haud crenulatis.

[Long. $5\frac{3}{4}$ - $6\frac{1}{2}$ lines, lat. $3\frac{1}{2}$ - $3\frac{3}{4}$ lines.

The clypeus (which is not separated from the rest of the head in any defined manner) is concave, especially towards the sides, the margins not defined, the front widely and gently emarginate.

The entire head is covered with small tubercles which are confused and obscure on the clypeus. The prothorax is nearly twice as wide at its widest part as down the middle it is long, and its base is about two-thirds again as wide as its front margin; its margins are sinuately divergent from the front to slightly behind the middle, where they are strongly and abruptly rounded, and then with a strongly sinuated curve converge to the base, but in such manner that they are nearly parallel close to the base and the whole prothorax has a cordate appearance; the front margin is very strongly emarginate, the anterior angles well defined; the base is scarcely bisinuate, the hind angles small, acute and directed obliquely outward and hindward; the disc is strongly convex, the lateral margins wide (together more than half the width of the disc) and very strongly reflexed; the surface of the entire segment is confusedly covered with tubercles which are very small and obscure towards the sides, but on the disc are considerably larger and more shining and sparing; the lateral edges are strongly crenulated. The scutellum is situated at the bottom of a depression in the elytra. These latter are not quite a quarter as long again as together wide, and are evenly and gently rounded laterally (the humeral angles quite rounded off); each of them bears four rows of strong, slightly shining, conical tubercles (about 7 or 8 tubercles in each of the inner two rows, about 5 or 6 in the next, and about 10 in the outer one, which is close to the margin); some of the tubercles are larger than others, but the large and small ones are pretty evenly distributed along each row; the tubercles have a little tendency to an elongate ridge-like form close to the base, and those of the outmost row are mostly a little smaller than the rest; the spaces between the rows of tubercles and between the tubercles in the rows is all uniformly rugose and finely but not closely punctured; the suture of each elytron is thickened and crenulate; between this and the first row of tubercles, and also in each interval between the rows of tubercles are a few very small tubercles; there is no defined line separating the upper surface of the elytra from their epipleuræ (which are strongly punctured), but a fairly distinct thickening of the margin (most

noticeable from beneath) divides them. The general style of puncturation on the underside consists of well-defined coarse punctures, each puncture containing a kind of granule on which is a golden seta; on the lateral parts of the prosternum the granules protrude, giving the appearance of tubercles; on the rest of the undersurface the punctures are rather feeble and sparing down the middle becoming deeper towards the sides; those about the sides of the sterna are the best developed, and show the golden setæ most conspicuously. The legs are punctured and clothed with short inconspicuous hairs; the tibiæ are straight, the anterior having a strong tooth externally, near the apex, in addition to the large robust apical spur. The prosternal process is horizontal and slightly prominent behind; it continues backward beyond the hind level of the coxæ and its hinder declivity is almost perpendicular.

This species must be somewhat closely allied to *S. Duboulayi*, Bates, but besides being much smaller differs *inter alia* in the elytral sculpture, which is devoid of any distinct costæ, the intervals between tubercle and tubercle in each row being quite continuous with those between the rows of tubercles.

I obtained two specimens of this insect dead, but very little damaged, in a spider's web under a log about twenty miles north of Port Lincoln.

THE DEVELOPMENT AND STRUCTURE OF THE PINEAL EYE IN *HINULIA* AND *GRAMMATOPHORA*.

BY W. J. MCKAY, B.Sc.

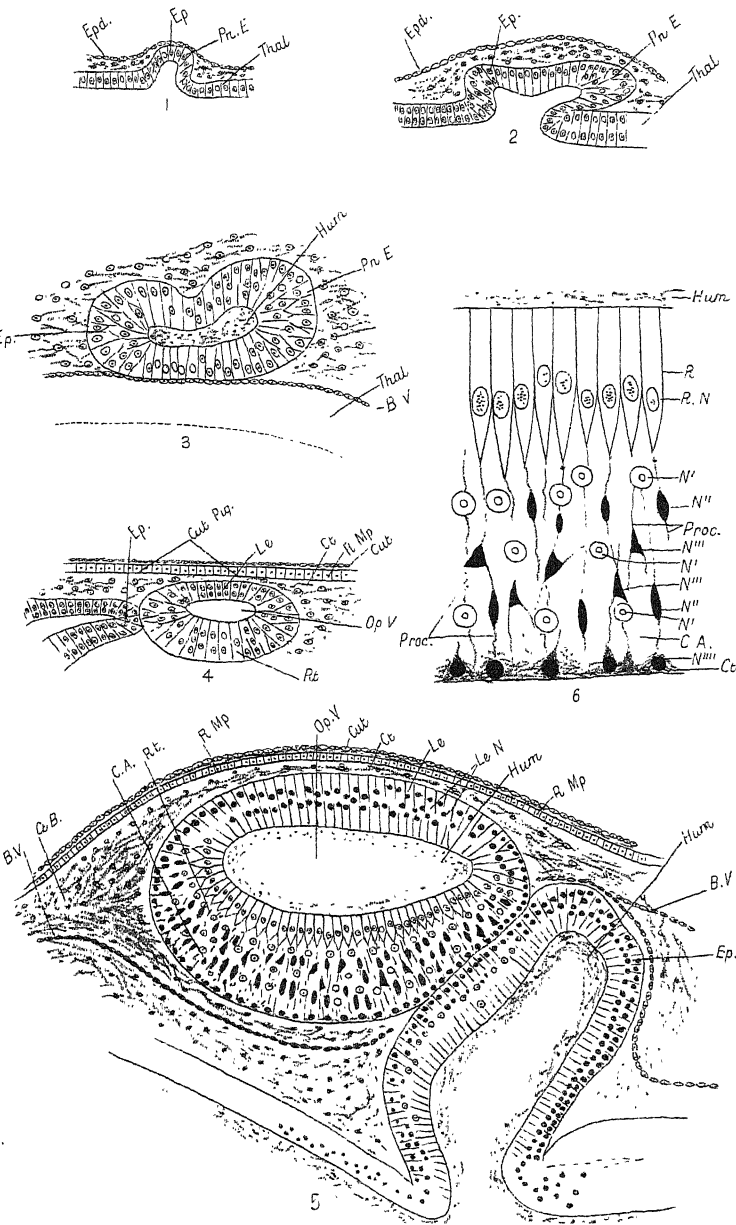
PLATES XXII.-XXIV.

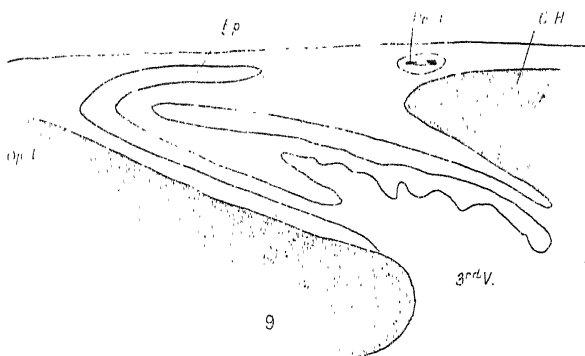
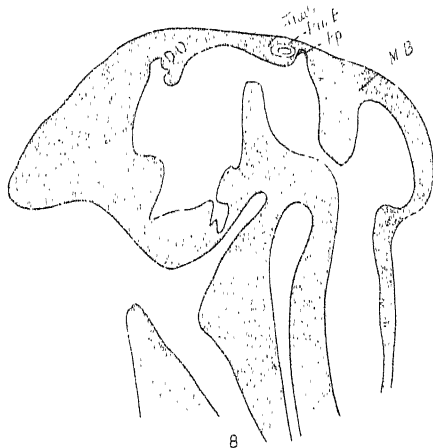
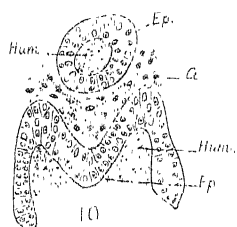
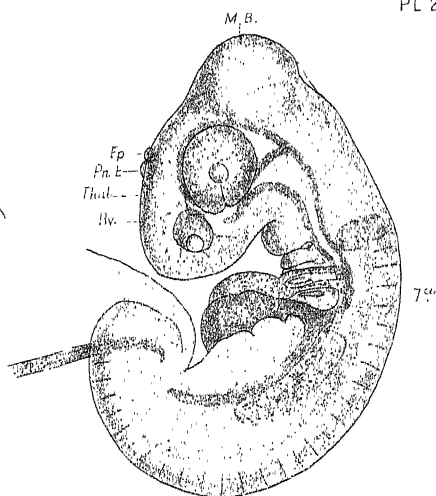
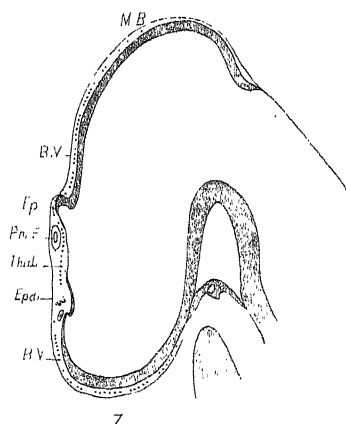
As considerable attention has been directed to the subject of the pineal eye since the publication of Professor Baldwin Spencer's paper,* it was suggested to me by Dr. Haswell, that some observations on the development of this organ might be of interest. What work I have done has been carried out at the Biological Laboratory of the Sydney University, through the kindness of Dr. Haswell, whom I have to thank for supplying me with portion of my material, and for his advice whilst I was working in the Laboratory.

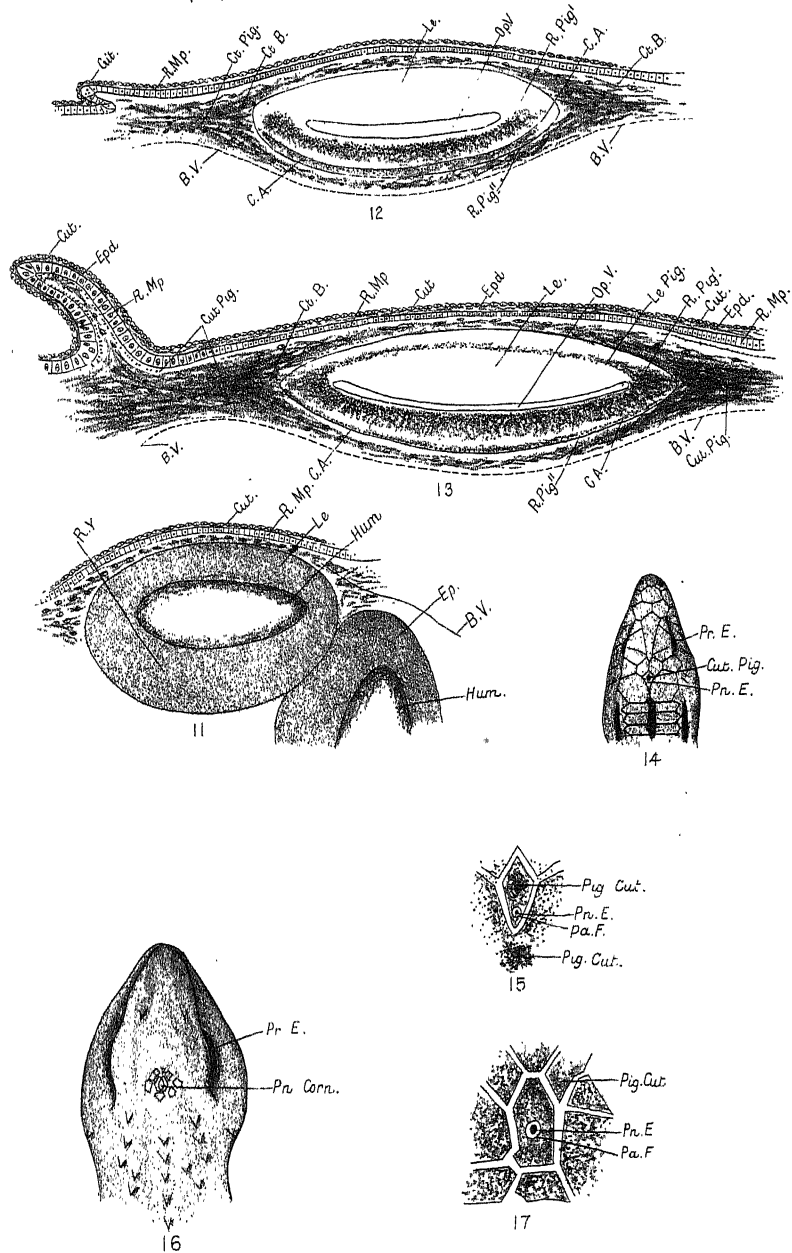
The material I have had, has been various stages in the development of three of our most common species of lizards, *Hinulia* (*Lygosoma*) *teniolata*, *Hinulia* sp., and *Grammatophora* (*Amphibolurus*) *muricata*. In the case of the latter, and I should think of *Hinulia*, development advances considerably before the ova have left the parent; so that it is necessary to obtain the ova in the lizard about the beginning of November, if the earliest stages are required.

In preparing the embryos in the earliest stages, I fixed with corrosive sublimate and hardened with alcohol; stained with borax carmine (Grenacher) and hæmatoxylin (Ehrich's)—the latter giving excellent results,—and then embedded in paraffine, after which ribbons of sections were cut with the rocking microtome.

*Quarterly Journal of Micro. Science, Oct., 1886.







External appearance of the pineal eye in the embryos.—In the embryos of *Hinulia*, which were advanced in development, the pineal eye could be seen standing out as a projection, at a point where the anterior joined the middle cerebral vesicle (Pl. xxiii., figs. 7, 7A, *Pn.*). The projection viewed as a solid object appeared to be composed of two lobes, an anterior larger, and a posterior smaller one. This appearance was explained when a longitudinal section of the head had been made; the anterior lobe was seen to be the pineal eye proper, while the posterior lobe was the curved end of the epiphysis (fig. 7, *Pn. Ep.*). In the more advanced stages of *Hinulia*, the eye appeared as a black spot in the median line of the head posterior to the paired eyes.

I have not been able to work out the earliest stages in the development of the eye in *Hinulia*, but I have obtained sufficient specimens of *Grammatophora* to give a fairly complete history of its earliest stages; and where the stages in this form ended, I have been enabled to complete them in *Hinulia*.

GRAMMATOPHORA MURICATA.

First Stage.—On making a vertical longitudinal section of the head of an embryo of this species, the walls of the cerebral vesicles are seen to be composed of columnar cells, covered by a layer of epiblast. The epiphysis cerebri or pineal gland arises, as is seen, as an outgrowth of the thalamencephalon. At this stage the outgrowth is composed of a single layer of columnar cells with well-marked nuclei (fig. 1).

Second Stage.—In the next stage the evagination or vesicle undergoes the following changes. The anterior wall begins to grow forward, and this soon leads to the formation of a second evagination in the wall of the primary one (fig. 2, *Pn.*). Thus we have two vesicles formed, an anterior larger (*Pn.*), destined to become the pineal eye, and a posterior smaller one (*Ep.*). Since the anterior vesicle grows faster than the posterior, it bends forwards, and its inferior wall rests on the superior surface of the

columnar cells of the thalamencephalon (fig. 2). The walls of both vesicles are composed of a single layer of columnar cells with oval nuclei. The nuclei, however, at this stage begin to undergo karyokinesis, and a second row of columnar cells is formed. As both vesicles increase in size they are carried more towards the surface, and the appearance then presented is that of a hollow stalk ending in the two evaginations, the whole being surrounded by embryonic connective tissue. Since the cavity of the brain is continuous with the cavity of the stalk and vesicles, we find that the coagulable fluid which bathes the cerebral walls, is also present in the latter (fig. 3, *Hum.*).

Third Stage.—In this stage the anterior of the two vesicles becomes constricted off to form the pineal eye (fig. 4, *Pn.*); while the posterior remains as the end of the epiphysis (fig. 4, *Ep.*). When viewed at this stage the eye is seen to be a double-convex body with a central cavity. Its superior and external portion is the rudimentary lens composed of columnar cells, while the inferior portion which is continuous with the lens, is the retinal region likewise composed of columnar cells. The cavity between is the optic vesicle containing the coagulable fluid referred to above. No differentiation has occurred in the retinal area up to this stage, and I am unable to say what the structure in the adult may be, as I have prepared no specimens. I may, however, remark that the retina becomes densely pigmented, and so the eye becomes very conspicuous when viewed as a solid object in the adult form (fig. 17). And also, as far as I can ascertain, there is no connection between the eye and the epiphysis.

The development of the eye of *Grammatophora* is somewhat similar to that of *Lacerta* as described by Hoffmann.*

HINULIA.

The stages I have of *Hinulia* have been from the time when the eye is differentiated off from the epiphysis.

Position of Eye.—The eye lies close to the surface, being separated from it only by a thin layer of connective tissue (fig. 5). No scales are as yet visible on the surface of the embryo;

* Weitere Untersuch. zur Entwicklungsgesch. der Reptilien. Morph. Jahrb., XI., 176.

but a single layer of squames resting on a layer of cubical cells represents the epidermis. There are no signs of pigment beneath the epidermis. The eye with the end of the epiphysis causes a marked bulging on the surface.

Shape of the Eye.—The eye is at this stage ovate in longitudinal vertical section, its long axis being placed parallel to the long axis of the head of the lizard, and it is slightly dorso-ventrally compressed. The following are the parts into which it is differentiated: above the lens, below the retina, and between these two the optic vesicle.

Lens.—The lens is concavo-convex in shape, the convexity being on the superior side. It is nearly the same thickness throughout, though where it becomes continuous with the retina it is slightly thinner. It is cellular in structure, and is composed of two layers of columnar cells with round nuclei. The nuclei stain very darkly, and lie in two rows about the optic axis; but at the place where the lens joins the retina the nuclei lie as a single row close to the external limit of the lens.

Retina.—The retina at this stage could be very well investigated histologically. It is composed of the following layers:—

First Layer.—Composed of rods (fig. 6, *R.*), occupying about $\frac{1}{3}$ of the whole thickness of the retina. These rods are closely placed side by side, and form the boundary to the optic vesicle; distinct oval nuclei with granular contents could be seen lying in the middle and lower portions of the rods. These nuclei do not stain very deeply. The rods end inferiorly by tapering to a point, and processes run from these points down into the retina below.

Second Layer (*N'*).—Is composed of spherical nucleated bodies. These bodies do not stain very deeply. They run round to where the lens joins the retina and then stop. Processes are given off from these elements, some of which run up to the rods, but the majority run down to the other retinal elements below.

Third Layer (*N''*).—A layer of spindle-shaped bodies staining very deeply. No nucleus could be detected owing to the intenseness with which these bodies took the stain; but they seem to represent the

nucleus, and a portion of the cell substance that has taken the stain to the same degree. These cells likewise have processes which proceed up and down.

Fourth Layer.—(a). A layer of cells (N''') similar to the second layer (N''). (b). Two layers of triangular-shaped elements with processes springing from the angles, and running in all directions. These bodies take the stain quite as deeply as the spindle-shaped ones above, and so no nucleus could be detected.

Fifth Layer.—(a). A layer (N'') of spherical cells similar to the second and fourth layers. (b). A layer (N'') of spindle-shaped bodies similar to, though more elongated than, the third layer. The processes from this layer run up sometimes to the rods themselves, but particularly do the processes run down to the layer of connective tissue below. As in the third layer these bodies stain very deeply.

Sixth Layer.—A clear region (*C.A.*) which is more noticeable in more advanced stages. It has no cellular elements in it, and it appears as a clear layer under a low power; but when examined by high power it is seen that the cell processes and the processes of the connective tissue (*Ct.*) cross through it. I cannot detect fibres running in any but the perpendicular direction, so that it cannot be considered as a real boundary layer separating the retinal elements into two divisions. I suppose it will correspond to Spencer's molecular layer (*l.c.* Pl. xvi. figs. 3-6. *Mo.*).

Seventh Layer.—A layer (N'''') composed of round nuclei with much connective tissue. In some places the nuclei can be seen to belong to columnar-like cells, but in the majority of cases the cell has disappeared, and the nuclei are surrounded by connective tissue. It is easy to see that if the columnar cells of this layer were to persist, a layer of cones would be formed, such as Spencer has described in some of his forms.

In some places in the retina it appears to me that there is a supporting network of connective tissue, in which the different elements are embedded. I think it is highly possible that

the elements of this complex structure of the retina arise from the breaking down of original columnar cells. The eye is marked off from the surrounding tissue very distinctly, but I do not think, however, that there is a distinct boundary layer. As regards pigment it has not yet made its appearance, so that this stage is especially suitable for the histology of the eye.

Optic Vesicle.—The optic vesicle (*Op. V.*), as before mentioned, is the space between the retina and the lens. It is filled with minute strands, to which I shall presently allude.

The epiphysis at this stage is composed of layers of columnar cells. The nuclei for the most part stain deeply, but occasionally a large round nucleus staining but slightly can be detected in that portion of the epiphysis which was directly continuous with the retinal part of the eye.

Spencer has drawn attention to Ahlborn's description of the epiphysis in *Petromyzon*, and I think that it is very probable, as he suggests, that the supposed nervous strands in the optic vesicle, as described by Ahlborn, are nothing more than the coagulable remains of the fluid contents of the brain cavity. The strands that can be seen in the optic vesicle of the pineal eye of *Hinulia* and *Grammatophora* are identical with the fine strands in the cavities of the brains of both lizards.

A blood vessel which runs along the roof of the brain dips below the eye. This vessel is very conspicuous when the embryo is examined alive (fig. 7, *B. V.*).

In the next stage of the development of the eye in *Hinulia teniolata*, we find that it has become separated off from the epiphysis, and a considerable space intervenes between the two (as shown in fig. 9). It is to be noted that no connection whatever now exists between the eye and the epiphysis. The eye (fig. 12) is seen embedded in connective tissue lying above the posterior portion of the cerebral hemispheres.

The epidermis above is composed of a layer of squames resting on a layer of columnar cells (*R. Mp.*). The first signs of the formation of the scales are now visible. The rete mucosum being

thrown into folds lined by loose connective tissue (which will become the cutis vera). The embryonic connective tissue which is to form this true skin, is arranged in a dense layer below the columnar cells of the rete mucosum.

The connective tissue surrounding the eye runs for the most part parallel to the long axis of the head of the lizard; it thus meets the ends of the eye and forms a kind of suspensory band, by which the eye is firmly supported (fig. 12, *Ct. B.*) The pigment of the skin has been developed at this stage, and runs in a broad band to the ends of the eye, where it dips down and runs beneath it (*Ct. Pig.*), no pigment being developed, however, between the lens and the epidermis.

Shape of the Eye.—The eye whether seen in longitudinal vertical, or vertical transverse section has much the same appearance. It is dorso-ventrally compressed, its long axis being parallel to the long axis of the head. In section it has the appearance of a small double-convex body placed in the concavity of a larger concavo-convex one. The smaller body is the lens, the larger the retina (fig. 12).

Lens.—The lens is double-convex, the convexity on the internal (inferior) aspect being much greater than on the external (superior), so much so that the latter looks flat by comparison. The lens is thickest at its optic axis, and from here it slopes rapidly away on its internal surface, so that on reaching the retina it has diminished to nearly one-half the thickness.

Histology.—The lens is similar in structure to the lens in the former stages, except that it seems to be composed of more layers of columnar cells, or else the columnar cells have elongated, especially in the region of the optic axis.

Retina.—The retina is now marked by the deposition of pigment granules. The pigment, however, is deposited only in certain regions as yet—viz., in (1) the lower ends of the rods (fig. 12, *R. Pig.*), (2) the line of spherical elements (*N'*) and (3) in the lowest

layer (fig. 6, *N'''*). Thus there is produced such an appearance, as De Graaf has described in *Anguis fragilis*, of a row of rods superior to the pigmented rods. This may be the explanation of De Graaf's figures, which Spencer has objected to. The pigment is deposited in the rods as minute particles in horizontal lines ; while it seems to be in vertical lines in the body of the retina.

The histology of the retina cannot be so well made out now as before ; but the rods, some of the spherical elements, the lower layer of spindle-shaped bodies, the clear area, and the lowest layer of nuclear elements can all be defined by examining a series of sections. Why the different elements cannot be so clearly made out, seems to be that the retinal elements are more closely applied one to another.

Third Stage.—The chief thing to be noticed in this (fig. 13), the last stage that I have, is the further development of the pigment, which now covers the whole of the rods in many places ; and where the lens joins the retina, the pigment reaches through nearly the entire thickness of the retina. Another point of importance is that pigment is developed in the lens. It extends as a band at the periphery of the lens. Above the eye the epidermis has become more marked, and is now represented by an external or cuticular layer, a lower and thicker layer which appears at first sight to be composed of wavy fibres, this being the scales in process of formation, and a third layer of columnar cells, the rete mucosum. All these layers are continuous over the eye.

In comparing the alteration in shape in the eye in its three stages, we see (by referring to figs. 11, 12, 13), that it is always double-convex in outline, but that the lens changes from concavo-convex to double-convex, and that consequently the optic vesicle presents at first a double convex outline in section, but that this alters to concavo-convex. And along with this change in shape of the optic vesicle, its vertical height decreases until it is almost nil. The chief factors in this obliteration of the optic vesicle are—(1).

The antero-posterior axis of the eye becoming much greater, and (2) the lens in the region of the optic axis becoming more convex internally.

While the eye has been undergoing these changes great alteration has also taken place in the epiphysis. It is no longer the simple hollow stalk which we saw in the first stages, but it has acquired the complex form shown in fig. 9. Its end is seen to be separable from the pineal eye by a considerable interval. This interval is, however, not so great in the later forms, owing I think, to the forward growth of the mid-brain pressing the pineal gland more towards the eye.

In examining the outward modification that takes place in the adult lizards in reference to the pineal eye, we note the following:—In *Grammatophora* (fig. 16), on the dorsum of the head at a point which is the apex of a triangle whose base may be considered as lying between the paired eyes, we find a white oval scale which indicates the pineal locality. This white body is the cuticle of the middle region of a scale, modified to form a cornea; it is quite devoid of pigment. On removing the cornea, we find a dark spot (fig. 17) lying in the centre of a concavity. The dark spot is the pineal eye lying in the parietal foramen, surrounded by unpigmented tissue. Its appearance is shown in fig. 17.

In *Himulia* no modification takes place in the scale to form a cornea, the only indication being a dark spot (fig. 14, *Pn. E.*) in the deltoid-shaped scale. A mass of pigment in the same scale, but anterior to the eye, might be mistaken for it. On removing the scale the eye is seen as a black spot with a clear centre (lens) placed in the parietal foramen (fig. 15).

On comparing the forms which I have described, with those forms described by Spencer, the following are some of the points which are similar, or dissimilar:—

(1) A scale is modified to form a cornea in *Grammatophora*, this being similar to such forms as *Calotes*, *Varanus*, etc.

(2) The lens is double-convex in outline, a point which appears to be common to nearly all the forms in which the eye is known.

(3) That the shape of the lens in the youngest stages of *Hinulia* is similar to the lens in *Cyclodus*, the eye in the latter being in a transitional state.

(4) As in some of the forms (*Varanus*, etc.) pigment is developed in the lens, so also in *Hinulia* is slight pigmentation present.

(5) The lens is composed of columnar nucleated cells.

(6) Retina. The columnar cells called rods are present.

(7) Nuclei are present in the rods in the later stages, a point not ascertained by Spencer in his higher forms.

(8) That the pigment is disposed in horizontal layers in the rods, and that where the rods join the lens the pigment reaches through the whole thickness of the retina.

(9) That a humour exists in the optic vesicle.

(10) That the rods have processes attached to the lower extremities.

(11) That spherical nucleated cells, similar to the *N'* layer of *Hatteria* exist in *Hinulia*.

(12) That the molecular layer (if it be such) of *Hinulia* is placed in a very different position to the molecular layer of *Hatteria* and *Varanus*.

(13) That layers of spindle-shaped elements exist, which have no correspondence to any of the elements in *Hatteria* or *Varanus*.

(14) That layers of triangular-shaped elements exist which have no correspondence to anything in Spencer's form.

(15) That no such bodies as cones exist in *Hinulia*.

(16) That the epiphysis as in *Calotes*, *Seps*, etc., is separated from the eye, and that no such structure as the pineal stalk is present in either of the forms examined.

(17) That the eye may be supposed to draw its blood supply from the large vessel so constantly present directly beneath it.

Mr. Whitelegge, of the Australian Museum, has kindly given me the subjoined list of thirty-five species of lizards, in which the pineal eye occurs.

1. *Odataria ocellata*, Gray; 2. *Hydrosaurus varius*, Gray; 3. *H. giganteus*, Gray; 4. *Hinulia (Lygosoma) elegans*, Gray; 5. *H. grayii*, Gray; 6. *H. Labillardieri*, Gray; 7. *H. australis*, Gray; 8. *H. tæniolata*, Shaw; 9. *H. Whitei*, Gray; 10. *H. Richardsonii*, Gray; 11. *Mococa Guichenoti*, Gray; 12. *M. Entrecasteauxii*, Gray; 13. *Hinulia* sp.; 14. *Tetradactylus decresiensis*, Peron; 15. *Hemiergis decresiensis*, Wagler; 16. *Omolepida casuarinæ*, Dum.; 17. *Soridia lineata*, Gray; 18. *Trachydosaurus rugosus*, Gray; 19. *Cyclodus gigas*, Bodd.; 20. *C. occipitalis*, Peters; 21. *C. Adelaidensis*, Peters; 22. *C. nigroluteus*, Wagler; 23. *Egernia Cunninghamii*, Gray; 24. *Tropidolepisma Kingii*, Gray; 25. *T. nitida*, Gray; 26. *T. major*, Gray; 27. *Physignathus Lesueurii*, Gray; 28. *Chlamydosaurus Kingii*, Gray; 29. *Grammatophora cristata*, Gray; 30. *G. muricata*, Kaup; 31. *G. reticulata*, Gray; 32. *G. angulifera*, Gray; 33. *G. barbata*, Kaup; 34. *G. ornata*, Gray; 35. *Moloch horridus*, Gray.

EXPLANATION OF PLATES.

LIST OF REFERENCE LETTERS.

B. V.—Blood vessel. *C. A.*—Clear area. *C. H.*—Cerebral hemispheres. *Cut.*—Cuticle. *Ct.*—Connective tissue. *Ct.'*—Connective tissue of retina. *Ct. B.*—Connective tissue arranged in a band acting as a suspensory ligament to pineal eye. *Cut. Pig.*—Pigment in cutis vera. *Ep.*—Epiphysis cerebri. *Epd.*—Epidermis (rudiment of). *F. B.*—Forebrain. *M. B.*—Mid-brain. *Hum.*—Humour of eye and brain. *Le.*—Lens of pineal eye. *Le. N.*—Lens nucleus. *N.'*—Spherical nucleated bodies of retina. *N."*—Spindle-shaped bodies of retina. *N'''*—Triangular bodies of retina. *N''''*—Deepest layer of spherical bodies. *Op. L.*—Optic lobe. *Op. V.*—Optic vesicle. *Pa. F.*—Parietal foramen. *R. Pig.'*—Pigment of retina and lens. *P. Pig."*—Lower layer of pigment in retina. *Pn. Cor.*—Pineal cornea. *Pr. E.*—Paired eyes. *Pn. E.*—Pineal eye. *Proc.*—Processes of retinal elements. *Rt.*—Retina of pineal eye. *R.*—Rods. *R. N.*—Rodnucleus. *R. Mp.*—Rete mucosum. *3rd V.*—Third ventricle. *Thal.*—Thalamencephalon.

Fig. 1.—The first stage in the development of the epiphysis of *Grammatophora muricata*. It is seen to be composed of columnar cells, and to spring from the junction of the thalamencephalon with the mid brain. The slight curve *Pn. E.*, is the first indication of the formation of the secondary vesicle to form the pineal eye.

Fig. 2.—*Pn. E.* secondary vesicle springing from the primary evagination. The lower portion of the vesicle rests on the upper part of the roof of the fore-brain.

Fig. 3.—Transverse but slightly oblique section of same stage as fig. 2. The strands of the coagulable humour are seen in the vesicles. Some of the cells are undergoing karyokinesis.

Fig. 4.—The pineal eye has become separate from the epiphysis. The epidermis is represented by a layer of squames (*Cut.*), and a layer of cubical cells (*R. Mp.*). Below this a slight layer of pigment is developing. The pineal eye is seen to be composed of columnar cells. Above is the lens (*Le.*), below the retina (*Rt.*) and between the two the optic vesicle (*Op. V.*).

Fig. 5.—First stage in the development of *Hinulia taniolata*, after the eye is separated from the epiphysis. The lens is composed of two layers of columnar cells with round nuclei, which stain deeply. Below is the retina composed of its several layers, some of which stain deeply, others do not. In the centre is the optic vesicle with humour. The epiphysis is seen to be composed of cells very similar to the lens cells of the eye. Below the eye the blood vessel (*B. V.*).

Fig. 6.—Layers of retina :—*C.A.*, the clear area containing nothing else but the cell-processes. This may be the molecular layer. *N'''* the layer of nuclei, some of which may be seen still to have the remains of a cell around them ; they lie in the layer of connective issue *Ct'*.

Fig. 7.—Section of the head of *Hinulia* sp., showing the position of the eye. In front of the eye is seen an evagination very similar to the eye itself. Behind the eye is the second alluded to in the text ; it is the end of the epiphysis. The blood vessel runs below the eye.

Fig. 7a.—*Hinulia* sp., viewed as a solid object; shows the pineal eye (*ln.*) as a projection on the anterior surface of the cerebral vesicle. The smaller projection *Ep.* is behind this.

[I have to thank Dr. Haswell for this figure drawn from a fresh embryo.]

Fig. 8.—Section of the head of *Hinulia tenuiolata*, showing position of pineal eye and epiphysis.

Fig. 9.—Section of head of *Hinulia tenuiolata*, showing position of eye relative to epiphysis. The eye is magnified in fig. 12. It also shows the complex form that the epiphysis take.

Fig. 10.—Vertical transverse section of portions of epiphysis (same stage as fig. 9.)

Figs. 11, 12, 13.—Section of eye in various stages showing the alteration which it undergoes. All figures are drawn to same scale.

Fig. 11.—Same as fig. 5. The eye is differentiated off from the epiphysis, but is not yet discontinuous with it. The skin is represented by two superficial layers, the cuticle and the rete mucorum, while below is the rudiment of the cutis vera. The lens of the eye is at this stage concavo-convex in outline, while the optic vesicle is double-convex. After this stage the shape of the optic vesicle is altered through the alteration in the outline of the lens.

Fig. 12.—The eye has become more elongated and the lens is now double convex, while the optic vesicle is concavo-convex; the retina remaining the same as before. Pigment is developed in the retina in the lower ends of the rods and about the first spherical layer of elements *N'*. Also, in lowest layer *N''''* (fig. 6). The clear area is now well-defined. The cuticular pigment is seen dipping down below the eye (*Ct. Pig.*). The front rudiment of scale is being formed. Blood vessel runs below eye. The connective tissue is collected into a suspensory band (*Ct. B.*).

Fig. 13.—Eye still more elongated, the optic vesicle still smaller in dorso-ventral direction. Pigment has developed in the rods, and at the place where the retina joins the lens the pigment is developed

throughout the whole thickness of the retina. A scale is formed composed of the cuticular layer of the epidermis (*Cut.*), the epidermis as a wavy layer (*Epd.*), and the rete mucosum as columnar layer, and below the cutis vera. (The connective tissue surrounding the eye has been represented rather too densely).

Fig. 14.—Head of adult *Himulia tenebrosa*, showing the appearance of the pincal region when viewed from above.

Fig. 15.—Scale shown in fig. 14 magnified, the cuticular layer being removed. The eye is seen as a dark body in the parietal foramen.

Fig. 16.—Head of *Grammatophora*; the cuticle of the scale modified into the cornea.

Fig. 17.—The eye of fig. 16 magnified, the scale, with the cornea removed showing the eye in the concavity of the scale, placed in the parietal foramen.

NOTES AND EXHIBITS.

Mr. North exhibited a set of the eggs (four in number) of *Aplonis fuscus*, lately collected on Lord Howe Island, by Mr. E. H. Saunders.

Mr. Ogilby communicated the following note on the cause of death in fishes from the National Park, N. S. Wales :—

“During the earlier part of the present month Mr. R. W. Robertson, M.L.A., brought to the Australian Museum two specimens of Black Bream (*Chrysophrys australis*), which, as he informed me, had been picked up dead above the weir in the National Park, and he also stated that two or three were found there daily in a dead or dying condition. Mr. Robertson, being anxious to know the cause of the mortality among the fishes in the Reserve, brought them to me, and a very cursory examination sufficed to satisfy me that death was due to the attacks of a species of *Saprolegnia*: being cognisant from personal experience of the ravages caused by the same or a similar fungus among the fresh-water fishes of the British Isles, I considered it advisable to notify our Fishery Commissioners of the presence of this pest, and on doing so was requested to proceed to the Park and examine into the state of the fish above the weir: accordingly on the following Saturday, the 16th instant, I proceeded thither in company with Dr. Cox and Messrs. Smithers and Whitelegge, the latter gentleman having been included at my request on account of his special knowledge of diseases caused by cryptogamic organisms; notwithstanding, however, that we tried every possible means of obtaining specimens, we failed entirely, and would have been obliged to return unsuccessful but that, at the furthest point to which our boat could go, one of the employés on the Park caught by hand a large fresh-water eel (*Anguilla australis*), which was endeavouring to climb up the face of a sloping rock; on examination, the reason for this extraordinary behaviour was at once apparent; the head, and especially the soft parts surrounding the

eyes and lips were covered, in many places to the depth of an eighth of an inch, with *Saprolegnia*; the branchiæ were almost entirely destroyed, and what remained was thickly covered with a fungoid growth; there were white leprous-looking patches here and there on the body and tail, and finally the pectoral fins had in a great part disappeared, the fungus, however, in this case being in all probability largely aided by the attempts of the fish to lift itself out of its natural element, since it had probably received considerable relief on previous occasions by employing similar means, it being well known that the *Saprolegnia* will not survive long out of water. Notwithstanding its total blindness, and the disease from which it was suffering, this fish was in good condition, and its stomach contained the remains of at least three Black Bream, which were most probably found dead at the bottom of the river, having themselves succumbed to the fatal attacks of the fungus; the intestines of this eel were in a perfectly healthy condition and entirely free from entozoa. As to the reason why this disease has taken so strong a hold on the waters of our National Reserve, I am of opinion that it is in great part due to the long continuance of the drought, as I was informed by the care-taker that the water during the last few months has been almost perfectly stagnant; to remedy this state of affairs I would therefore advise—there being absolutely no fish worth mentioning left to preserve—that the flood gates be opened, and all the water be allowed to run off, and so as far as possible dry up the bed of the river, and run off the spores of the fungi, while at the same time the remnant of fish still surviving in the infected waters, and which are chiefly Black Bream and Mullet, would escape to the estuary, in the saline waters of which the *Saprolegnia* would quickly perish. Mr. Whitelegge has kindly set up slides of the fungus from the eel, and will exhibit them when the meeting is over.”

Dr. Cox pointed out that the epidemic mentioned by Mr. Ogilby was simply due to the unhealthy and unnatural conditions under which the drought had compelled these particular fishes to live, and that there was no ground whatever for any public alarm.

Mr. Whitelegge exhibited under the microscope preparations of mycelia of the fungus referred to in Mr. Ogilby's note.

Also a well-preserved specimen of *Neis cordigera*, Less., one of the Beröidæ from Port Jackson, obtained in the month of June.

Also the fat of some beef which for some days past had been observed to be phosphorescent.

In regard to the preceding exhibit, Dr. Katz suggested that the phosphorescence was probably due to contamination from seawater, or perhaps from fish.

Mr. Fletcher exhibited three living and four spirit specimens of *Peripatus* (supposed to be *P. Leuckarti*, Säger), and in reference to them read the following note:—"Ten days ago (June 17th) Mr. A. G. Hamilton, Mr. R. T. Baker and myself were walking along a country road a few miles out of Wollongong, not thinking about *Peripatus* at the time, when on casually turning over a stone left by the road-makers on the edge of the road we unexpectedly picked up a specimen. Search was then made under the remaining stones along the road, and in the space of about 100 yards five others were found. The seventh was found under similar circumstances the next day in another direction. Three of the specimens (females*) were kept alive, and I have thought it worth while to record a few notes on the appearance of these, preserved specimens undergoing considerable alteration in colour. In size they vary from about 15-18mm. in length by 4-5mm. in breadth when contracted, to about 40mm. by 3mm. when extended and crawling. From the base upwards for some distance the rings of the antennæ are pretty regularly alternately light and dark coloured. The colouration of the body differs considerably in different specimens, no two of the three being exactly alike, though there is a general similarity of pattern. Mr. Tryon, presumably speaking of Queensland specimens, says that the colour is indigo-blue; in this respect ours are different, the prevailing colours being dull black or brown and red. On the median dorsal surface in all three there is a fine dark median longitudinal line, red or black, presenting at regular intervals knot-like enlargements, of which there are about sixteen altogether, the first one behind the

*One of these was subsequently dissected and proved to be pregnant.

antennæ, the others opposite the members of the several pairs of legs, the first few however smaller and not so well-defined as the others. As regards details the specimens may be distinguished as follows:—(a) the median line dark ferruginous red, the papillæ for a little space on each side of it a lighter and less intense red, most noticeable at the knot-like enlargements where there is a distinct somewhat triangular patch on each side extending outwards a little way and tapering slightly; on the sides of the body extending some little way dorsad of the attachment of the legs is a broad lateral light red or ferruginous stripe, separated from the median nodose line by an intervening broad band on each side in which to the unassisted eye a dark tint—dark brown or black—is predominant, though there is a good deal of inconspicuous red, examination under a low objective showing that some of the papillæ are red, or have red bases and black apices, on a dark back ground; the lateral red stripes pass into the still paler red of the undersurface which just ventrad of the bases of the legs shows small irregular blackish patches, the inner surface of the legs also streaked longitudinally with black, and a few small black patches at intervals in the median line; the head beneath all round the oral aperture, the colour extending upwards to between the bases of the antennæ, black: (b) the median nodose line black, the rest of the body to the naked eye of a fairly uniform dark tint (black with a tinge of purplish), but with a lens one sees that there is a good deal of inconspicuous dull red as there are not only isolated red papillæ but the transverse rows of them alternate pretty regularly with rows of dark ones; lateral stripes are not defined, but the papillæ on the flanks are paler in colour, some of them almost whitish; the undersurface is paler in colour, with a blackish longitudinal streak on the inner surface of each leg: (c) somewhat intermediate in character; the median nodose line black, each of the enlargements in a patch of lighter colour of the same shape as in (a) but of a light and rusty tint; lateral stripes are not well defined, but above and corresponding with the interval between two consecutive legs on each side, there is an irregular rusty almost yellowish patch bordered above and below by an irregular black patch; the rest of the body dull rusty red, almost brown, blotched with black; the undersurface shows

an irregular median longitudinal blackish band sending off branches to the legs, the remainder being dull rusty red or brown. In all of them the transverse rows of papillæ on the outer surface of the legs are pretty regularly alternately light and dark coloured. The four spirit specimens are more or less similar to one or other of the above described. On comparing our specimens with Captain Hutton's description of *P. Novæ-Zelandiæ*, one is struck with the great resemblance, in respect of the external characters. The only diagnostic characters mentioned in the abstract of Sænger's paper (Arch. f. Naturg., xxxvii. Jahrg., II. Bd., p. 406) are the presence of fifteen pairs of claw-bearing legs, the situation of the generative aperture, and the characters of the leg-pads; the latter, however, are not of specific importance, Sænger's figure evidently having been drawn from a more or less shrivelled specimen."

Postscript.—When the above note was read I was not aware of the publication of Mr. Sedgwick's monograph (Q.J.M.S., April, 1888), from which it appears that Queensland specimens differ somewhat in colour from those referred to above. My Gippsland specimen was dead and dried up when I received it, hence it is not in a very favourable condition for comparison; but as far as I can make out it is not unlike a much bleached example of one of our dark specimens from Illawarra; a whitish median dorsal line visible in part of the body only is evidently due to bleaching, though in the rest of its course a nodose black line is not well-defined.

Mr. Sinclair exhibited portions of diamond-drill cores from the Astoria works, East River, New York.

Mr. Brazier exhibited a specimen of *Physa gibbosa*, Gould, obtained more than a month ago in Waterloo swamps, since when, though it had been merely left in a corked tube with a little water, it had deposited a quantity of spawn.

Dr. Cox exhibited specimens of a river-limpet (*Ancylus Irvinæ*, Petterd), from a large lake in the interior of Tasmania.

Also a Tertiary fossil from the Wild-horse Plains, which he believed to be identical with *Thylacodes decussatus*, Gmel., a living Port Jackson species.

Mr. Fletcher exhibited specimens of the nine species of earth-worms described by him, in addition to examples of several species of which an insufficient supply of material does not at present admit of satisfactory description.

Mr. Ogilby exhibited a specimen of *Monacanthus maculosus*, Rich., obtained off Cockatoo Island, and stated that the Australian Museum had not hitherto possessed a specimen ; it was presented to that Institution by the Hon W. Macleay. He also exhibited a parasitic Entomostrakon from the Mackerel, belonging to the genus *Lerneonema*.

Mr. Whitelegge exhibited a collection of Foraminifera from the waters of Port Jackson. There were no new forms of importance.

The President exhibited the fossil from Cockatoo Island, mentioned in his paper, and a similar one from Stuttgart, Wurtemberg, with full size photographs of each.

The President exhibited, for Dr. Woolls, the plants referred to in his note.

I. A. R. I. 75.

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